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Electrical World

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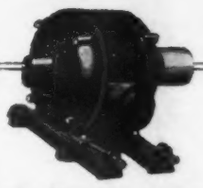

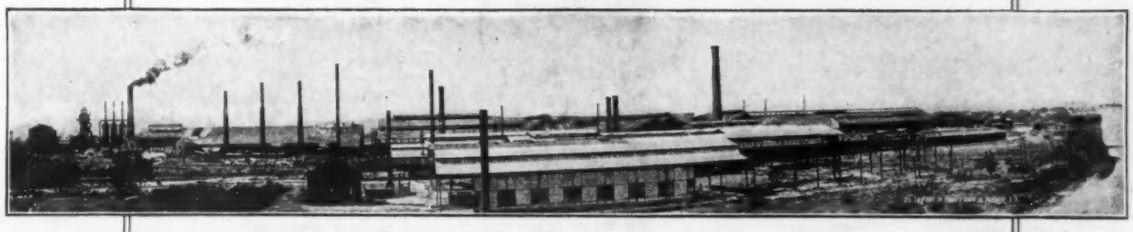

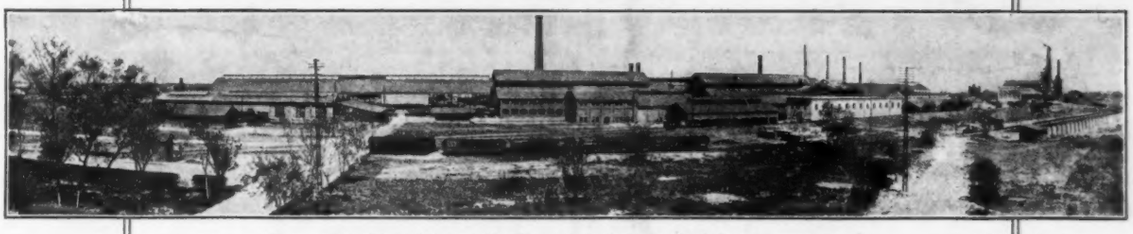

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Writes the Director General of this Mexican Steel Mill, "We now have about 200 horse power of these motors scattered around over our steel mill and in all kinds of work, where iron ore dust, grit, dirt, ashes, etc., have excellent chance to get in and do their worst damage to motors.

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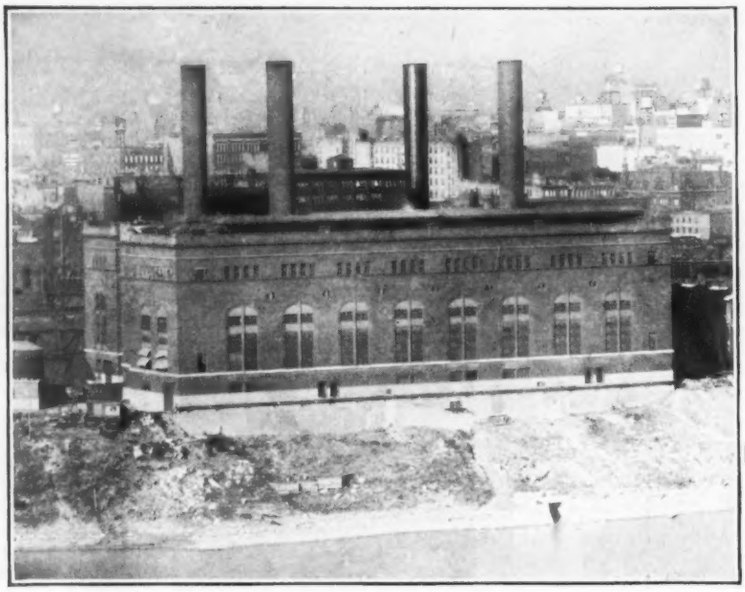
Howell Electric Motors Company
Howell, Michigan

Howell RED BAND ELECTRIC Motors

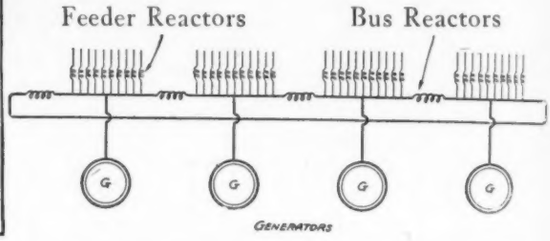
Metropolitan Current Limiting Reactors *for* Generator and Feeder Protection at Cincinnati, Ohio



Union Gas & Electric Company Plant, Cincinnati

This diagram shows how Metropolitan reactors protect the generators and feeders at the West End Station of the Union Gas & Electric Co., Cincinnati, Ohio.

This company first used reactor protection for generators with the result that Metropolitan reactors were also specified for feeder protection.



Maximum protection is assured where reactors are used for generator, bus and feeder reactors.

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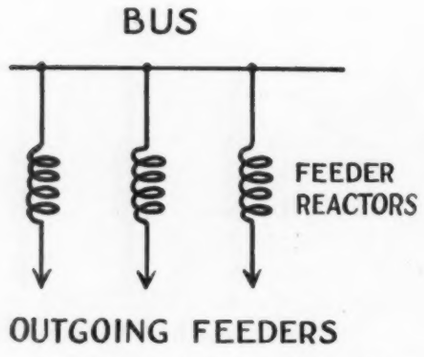
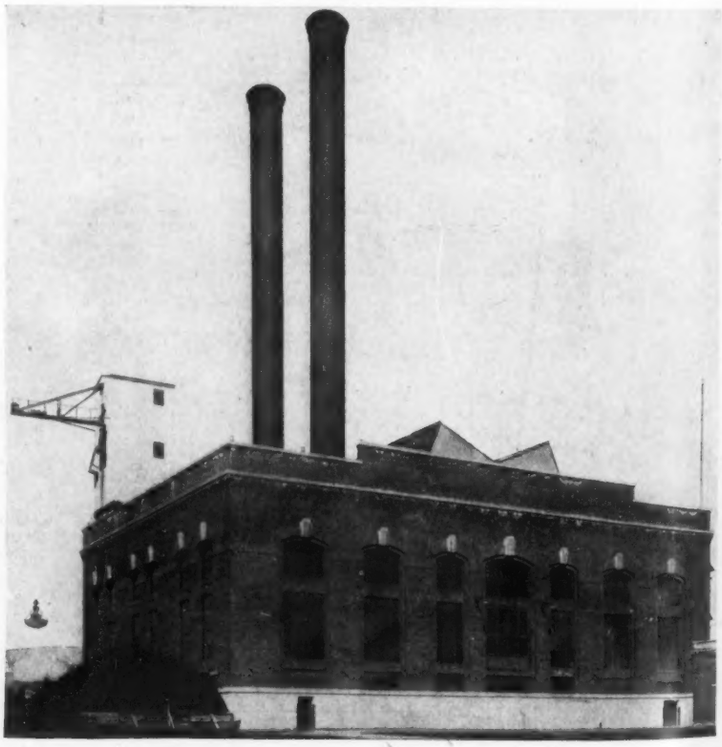
Here at Albany, the 12,000-volt, 40-cycle feeder circuits of the Municipal Gas Company are protected by all porcelain clad 5% Metropolitan Reactors. They guarantee minimum energy losses, space requirement and temperature rise.



Line Diagram of Feeder Circuit with Metropolitan Reactors



Municipal Gas Company, Albany, N. Y.

Metropolitan Device Corporation

1250 Atlantic Avenue, Brooklyn, N. Y.

Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

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W. H. ONKEN, JR.

Editor

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Two Good Moves in Washington

TWO very positive and hopeful steps in the reorganization of government departments have been taken recently. The Patent Office and the Bureau of Mines have been placed in the Department of Commerce under the executive direction of Herbert Hoover. These logical moves should be followed by improvements in these departments which will eliminate certain criticisms heretofore existing. In particular, it is to be hoped that the Patent Office will be able to expedite its routine procedure and retain its competent personnel, for it should be an asset and not a stumbling block to the rapid development of industry. The Bureau of Mines has done notable work in the past and under the new arrangement will be in a still better position to benefit industry.

These changes are in line with well-studied plans for making the government bureaus more efficient and less complex and are certain to be followed by other simplifications. Under the able direction of Herbert Hoover this particular reorganization promises to be completed rapidly and the new alignment of departmental activities can be formed correctly. Waste in government should be eliminated as well as waste in business, and an auspicious start has been made.

More Power to the Power Club

THE Electric Power Club has done good work for the electrical industry. Starting as an informal association of motor manufacturers it has grown and expanded until it takes in virtually all manufacturers of electrical power equipment. It is doing several things which eliminate waste in manufacture. It brings together executives of the manufacturing branch of the industry so they may become acquainted with each other and with their common problems. This makes for good fellowship in a highly competitive industry. It enables the electrical manufacturers to join together in work for the common good. They can discuss the basic economic laws under which they operate and can learn how to perfect their organizations in the best way to meet local needs, and they can co-operate as a unit with other branches of the industry.

A major and very valuable work of the Power Club is the making of standards. These standards have become recognized as assets highly important to industry. Without stifling initiative in manufacture, they have stabilized the industry greatly, eliminated a great amount of waste and simplified the manufactured products. Recently a step in advance has been taken by issuing instructions for the operation and maintenance of equipment so that users may have available the best practice in the opinion of the makers of the equipment.

Thus the Power Club serves as a meeting place of executives, as a place where electrical manufacturers can act as a unit on industry problems and as a place where standardization in manufacture can be accomplished. All these worthy services have been rendered in large measure, and it now seems possible they can be increased in potency. The recent decision of the Supreme Court affecting the activities of trade associations bids fair to open up new prospects for executive activity in the Power Club which will not infringe the law. If the possibilities discussed by Francis E. Neagle and Gilbert H. Montague on page 1288 of this issue can be realized, the Electric Power Club can do much more to stabilize and improve the manufacturing branch of the electrical industry.

Worth of Service Versus a Fair Return

THE value of utility service to the consuming public has lately received some consideration in regulative quarters as a potent if not a controlling factor in rate making. We have heard the point made that in establishing a rate sufficient to produce a fair return the character and quality of the service rendered must be borne in mind and that the rate must be limited by what the service is reasonably worth, even though the return on the fair value of the property is less than the average recognized reasonable rate of return. Thus the issue is joined between the need of a reasonable return and the value to be placed on the service by the consumers.

It is beyond dispute that the fair and reasonable costs of any given standard of service must be met through revenue derived from operation unless deficits are made up by taxation subsidy as in some of the so-called "service-at-cost" legislation applied in late years in the electric traction industry. If the total costs of a given service are not met—and these, of course, include all overheads and a yield which attracts capital for expansion—the service standard must go down until cost and revenue are equalized. Once the costs of a given service are determined, using the word "costs" in its broadest sense, we believe that the value of that service must be determined by the customers and not by the commission. The rate necessary to yield a reasonable return on a fair rate base would seem to be the dominant consideration.

In a particular case it might happen that this reasonable rate would appear prohibitively high to the commission, which might doubt the willingness of the customers to pay it. It is true that ironclad proratings of classified service costs cannot be established and maintained under the practical exigencies of operation, but for a property as a whole the total costs of service must be met on the average or disaster will overtake it. Is it not also true that if a rate appears prohibitive, though not unreasonable, the company and its patrons should have the opportunity to test it if the judgment of the management approves? In many cases the management will decide to try a rate lower than the so-called prohibitive one in order to attract business,

increase volume and cut costs; but it is hard to escape the conclusion that if a rate is found reasonable after due investigation by the commission, subsequent proceedings should be unhampered by such a body's preconceived ideas of the worth of the service to the public. We believe that attempts to limit the rate to what the service may or may not be worth carry a regulative body dangerously near the rocky coast of confiscation. The most reliable course is to steer by the true meridian of the reasonable return.

The Public and Radio Interference

NOT every one will acknowledge that radio broadcasting has acquired the status of one of the public utility enterprises. None the less, the enormous radio public, however unthinkingly, attaches almost as much importance to it as it does to its electric service, electric transportation and electric communication. This is a fact, not a theory. Is it not time, then, that the proprietors of these established electric utilities give consideration to the crystallizing opinion of that public—which is the same public for all services? The radio listeners today are very critical of the quality of the programs and of the quality of reception. This very condition renders the listeners particularly prone to attribute to unwarranted sources the disturbance by others of their unalloyed enjoyment of radio programs. They perhaps are not sufficiently thoughtful to weigh the relative social importance to them and to their neighbors of the broadcasting service as contrasted with the entire group of utility services based on the use of electricity.

Analysis of letters received by radio broadcasting stations seems to indicate that a large percentage of our population is deriving an unusual degree of enjoyment, and perhaps profit, from the composite radio programs. This may be due to the recreative value of the programs received by many whose working hours are absorbed in employment of a routine character. The letters also throw some light on the now generally accepted notion that not all "static" is atmospheric.

How many of these listeners have been educated by those who are best qualified to enlighten them to appreciate that many, if not most, of the causes of radio interference exist in their own sets, in neighboring sets or even in defective electrical equipment or wiring in the same house? The radio enthusiast in street conversation talks mysteriously of arcing grounds, leaky insulators, lightning arresters becoming charged, etc., but seldom mentions the heating pad, motor, loose socket, defective flatiron, violet-ray apparatus and similar things.

The problems of the utility companies are never ended, and the radio problem is merely one of the newer "slants" of public relations. One Eastern company met it recently by assisting in a very material way to make successful a meeting held by an A. I. E. E. section at which the true status of the many varied causes of radio interference was established experimentally. The audience of one thousand and five hundred consisted mainly of radio "fans," and one cannot help feeling that that community at least will modify its unthinking attitude. There are, of course, other methods of approach, but a public meeting at which an excellent radio program, excellently received, was purposely ruined by the homeliest of means cannot be classed as the least effective.

Breaking Records in Generating Units

THE size of generating units seems limited only by load demands. Each year sees records broken for both steam and hydro-electric machines, and news of the purchase of a 100,000-kva. cross-compound turbo-generator by the Brooklyn Edison Company again sets the record for size. The Commonwealth Edison Company also has ordered a new unit of 77,000-kw. rating.

The capacity of stations keeps pace with that of the units, and the 700,000-kw. plants contemplated for New York and Chicago will hold the record only a short time if the industry continues to grow at its normal rate. A balance between load demands and the most economical way of generating energy to supply these demands requires larger units and larger stations as consumption increases.

Necessarily the increase in the size of stations and of generating units is accompanied by changes in the principles of station design. At present there is a decided trend toward the construction of stations on a sectional plan. Each group of boilers, generators, auxiliaries and switch house forms a unit station and other unit stations are placed parallel with it in one common building structure. This is rapidly leading to the elimination of partition walls between boilers, turbines and switch house in each unit of the station and the installation of partition walls for separating adjacent unit stations in a common building.

Safety, economy and operating convenience dictate this change in design practice for large stations. An accident to a boiler, a turbo-generator or a bus hazards service in one compartment only of the plant. The use of very large boilers and turbines and the necessity to reduce energy concentrations on the generator bus, together with an improvement in equipment to the degree where all parts of a unit station shall be equally reliable and equally essential to service, add to the advantage of the design. Shorter lengths of piping can be used, building volume can be reduced and operating safety can be increased.

Thus the introduction of larger units means not only a decrease in fuel economy and capital cost per kilovolt-ampere of the generating unit; it has also led in the direction of decreased unit station cost, to increased economy in operation and maintenance and, best of all, to better and more reliable service to customers.

Status of Domestic Refrigeration

FOR the last fifteen or twenty years central-station executives and commerical men have been looking for a domestic refrigerator that would work. They have realized that such a device, if it were reliable, would find a ready sale. Moreover, its addition to the electrical equipment of a substantial number of domestic customers would not only double the revenue from the individual user, but in many instances it would turn the residential lighting load from an unprofitable to a profitable and desirable class of business.

Within the last two years several manufacturers of domestic refrigerators have overcome most of the mechanical as well as the financial difficulties which have hampered development, and they are putting out dependable machines. Some, in fact, have their factories turning out complete refrigerators at the rate of one hundred a day and are planning to increase their capacity. The immediate effect of even this comparatively

small quantity-production basis has been a certain much-desired reduction in prices and the introduction of a self-contained unit which can be sold for approximately $250.

The available market is a long way from saturation. Most recent figures place the number of domestic refrigerators in use at between sixty-five and seventy thousand. This year's production will be about 80,000 machines, and it is expected that the figure for 1926 will be 200,000 or 250,000. It has been estimated by some that people with incomes of $5,000 or more are the best immediate "prospects" for domestic refrigerators. Others are inclined to think that approximately 10 per cent of the total number of residential customers may be classed as eventual customers for this device. Either way it appears that at present prices there is a first-class market for the sale of a million or a million and a quarter domestic electric refrigerators. Of course, as production is increased price reductions will quite naturally follow, with the consequent widening of the market.

However, each refrigerator sold will add at least $40 per year to the residential customer's bill. The central-station industry therefore has in the domestic refrigerator, under present conditions and prices, the possibility of adding $50,000,000 annually from domestic customers without additional investment in plant or system capacity to serve this load.

Polarizable Spheroids and Milk Test

IT IS always a pleasant duty to point out on these pages useful practical results unexpectedly obtained from purely theoretical research in physics. In an industrial organization the research physicist or chemist stands perhaps in the farthest zone from the money center, and in dry years the flow of precious metal is often absorbed by the preceding arid zones before it reaches him. It is therefore of importance to keep the practical importance of uninterrupted mathematical, physical and chemical research before the eyes of the management.

Long ago Maxwell, and after him Lord Rayleigh, became interested in the conductivity of a liquid in which non-conducting spheres are fortuitously distributed in suspension. To them it simply was an interesting mathematical and experimental problem—one on which, moreover, they could check some of the fundamentals of electrical theory. Later Millikan made extensive experiments on the dielectric constants of suspensions of mixtures of benzol and chloroform in water, and recently these investigations have become of additional value in the calculation of the deformation of the atom when it passes from the gaseous or solute state to that of the liquid or solid.

Quite recently Dr. Hugo Fricke of the Cleveland Clinic Foundation has extended the classical theory to include the electrical conductivity of a suspension of homogeneous fortuitously distributed polarizable spheroids for purely practical bio-chemical purposes. In the first article of the series *(Physical Review,* 1925, Vol. 25, page 361) he shows a simple and accurate method for the determination of butter fat in milk and cream. This is done by measuring the electrical conductivities of the separated skimmed milk and cream and of the mixture as a whole. He asserts that the precision of this method is far higher than that of the usual non-electrical Babcock test. It looks as if in a not far distant future, with a simple Wheatstone bridge, one will be in a position to check up on the milkman right at the breakfast table.

In the meantime here is another contribution of physical science to the welfare of humanity. The same method has also been applied with gratifying results to blood analysis. The preceding generations have supported pure scientists on whose work we are now "cashing in." We cannot repay them except by supporting investigators in pure science of our own generation, whose work will make the lives of our children's children easier. Only in this way can the debit and the credit sides on the books of each generation be made to balance.

Simplification of Electric Wiring and Lighting

RELATIVELY few persons who are now enjoying the comfort and convenience of electric service remember, or perhaps even suspect, the chaos which existed in the early years of the industry. To appreciate fully the multiplicity of designs of sockets for electric lamps one must view a display of these fifty-seven varieties. At the present time sockets, and consequently lamp bases, are of a standard thread and of four sizes, with one of them overwhelmingly in general use.

Perhaps a faint picture of the chaos which prevailed long ago in socket designs can be evoked if one recalls the more recent, and still not uncommon, difficulties with convenience outlets and attachment plugs in unpleasant variety. By experience the customer learns what his own particular kind of attachment plug must be and perhaps remembers to have this supplied with his electrical appliances and portable lamps. When he moves it may be necessary to change all of them again. Fortunately, this condition is rapidly improving through recent standardization.

Another phase of simplification which is very important in decreasing inconvenience and in reducing the cost of electric lamps is voltage standardization. In this the central-station companies have generously cooperated so that only a few voltages are necessary. In fact, most lamps are now being furnished in one or two voltages. Correct voltage is very important in light production because of its relation to the life and the efficiency of lamps. The standardization and simplification of voltage is well on its way toward complete realization.

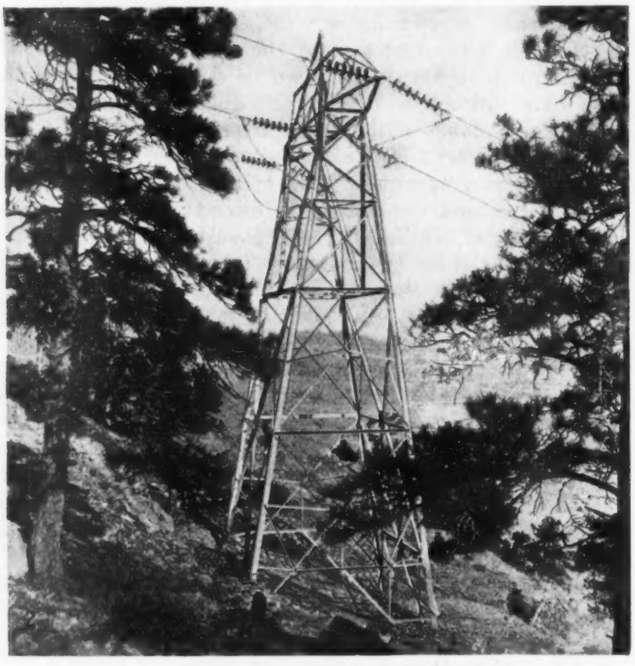
There remains the consideration of the lamps themselves. Aside from the standard bases for general use, of which the medium base is overwhelmingly prominent in the home and many other places, there is the variety of bulb shapes and finishes to consider. If one examines lamp displays, he finds an array of shapes and of finishes—clear, all-frosted, bowl-frosted, etc. When lamps are shaded as they should be, certainly the need for many different bulb shapes disappears. This is also true of some of the finishes. An all-frosted lamp at the present time is only a few per cent less efficient in light production than a clear lamp. In many cases this slight deficiency is more than compensated for by a more pleasing lighting effect. Certainly there is room for simplification in electric filament lamps and, judged by the progress which has been achieved with sockets, lamp bases, convenience outlets, attachment plugs and voltages, it is likely that lamp bulbs will eventually receive the attention they should have.

Valmont station and artificial lake

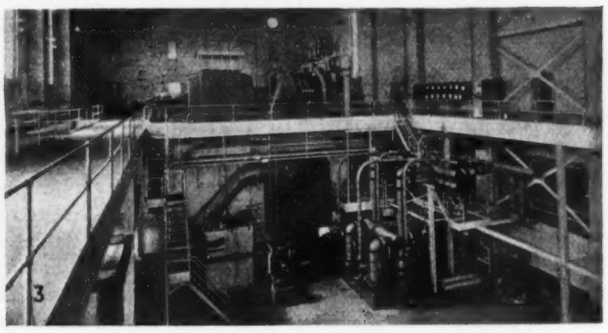
Valmont Station in Colorado

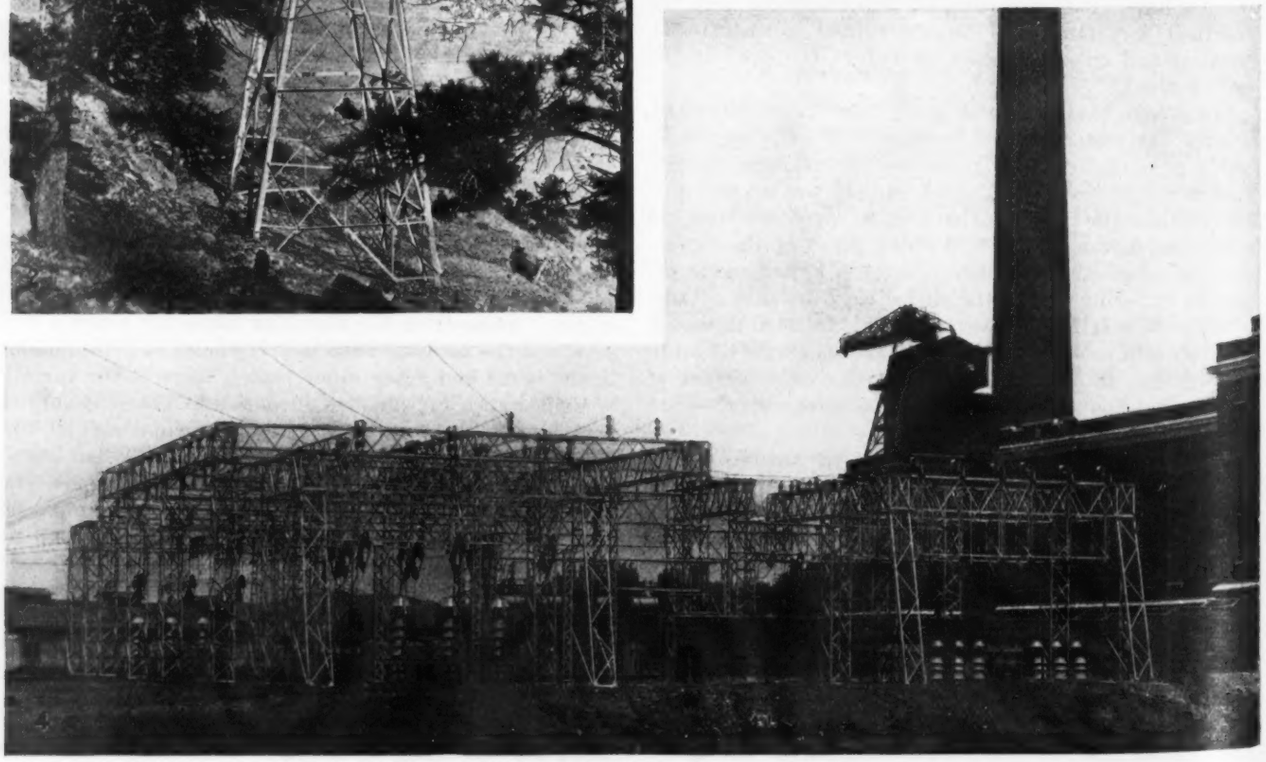
The Public Service Company of Colorado Builds Artificial Lake to Serve Irrigation and Circulating Water Needs—Some Unusual Design Features Used in Plant and Line Constructions

Dead-end tower on 90-kv. Valmont-Boulder Canyon line



Interior of turbine room of Valmont plant





Outdoor substation at Valmont plant, showing 90-kv. and 44-kv. buses

Mechanical Strength of Insulators

Well-Designed Insulator a Compromise Between Working Load, Ultimate Test Strength and Thermal Stress—Discussion of the Modern Insulator Problems

By A. O. AUSTIN
Chief Engineer the Ohio Insulator Company

THE necessary mechanical strength in the suspension insulator for the modern transmission line raises many pertinent questions, and while it is not the intention at this time to discuss this matter in all its phases, some of the considerations will no doubt be of interest.

Whereas a conductor of 4/0 capacity was considered one of large size in 1909 or 1910, we now have to deal with conductors of 1 in. or even 1¼ in. in diameter, with the possibility of even larger sizes in the future. The important thing to take into consideration, however, is that the mechanical strength of insulators being used on the lines today is less than that of many of the designs made up in 1908 and 1909. Since operating records have been obtained from many millions of insulators, it is important that present-day practice be looked into rather carefully as a guide to what may happen in the future.

The design of the insulator is essentially a compromise, and if one property is developed at the expense of another, the general result is likely to be poorer than it should be. Thousands of miles of circuit are carried today on insulators which have ultimates that would have been considered too low for lines in 1909 and 1910. Since a condition of this kind exists, it is advisable to investigate the various factors which tend to determine the working load and ultimate in the insulator.

There is little or no question that the greatest troubles with insulators have come, not from using insulators with too low an ultimate, but from the use of those which showed up to best advantage on mechanical tests. This applies to pin types as well as to suspension insulators. The great trouble has been that the thermal stresses which produce failure of the insulator by cracking were the real determining factors rather than the external mechanical load. The time lag required to bring out defects of this kind makes it exceedingly difficult to determine by any test what the performance will be.

The factors which determine the load on the insulator are as follows:

(a) Conditions or factors which tend to call for a higher ultimate in the insulator:

1. Higher strength conductors.
2. Higher tension in the conductors.
3. The use of dead-end insulators.
4. The use of semi-anchor insulators.
5. Long spans.
6. Small sag.
7. Vibration.
8. Arcs to ground.
9. High grip in the clamps.

(b) Conditions or factors which tend to permit a lower ultimate in the insulator for a given size of conductor.

1. Short spans.
2. Greater sag.
3. The elimination of dead-ends and semi-anchors.
4. Multiple strings.
5. Limited grip in the clamps.

In this discussion it is assumed that a good working compromise is to be established and that one factor is not to be carried to an extreme at the expense of another. The design of a transmission line is a problem in balancing various hazards, keeping in mind the fixed charges and the value of reliability at all times.

High-Strength Conductors

High-strength conductors do not necessarily mean high working stresses on the suspension insulator. The load on the suspension insulator depends entirely upon the size and weight of the conductor and the load imposed by wind and ice and the length of the span, regardless of whether a high or low tension is used in the conductor. This of course does not apply to angles, dead-ends or peak towers. In the case of a break in the conductor, a light grip in the suspension clamp as well as the swing in the string will limit the amount of load that can be thrown on the insulator. In the case of the large conductor, mechanical breaks will be few, so that even if some damage occurs to a suspension string or two, the matter is not a serious one, particularly if a greatly increased life and lower fixed charge are provided for the insulator.

Vibration and sag, while affecting the insulator, are more likely to be limiting factors in the case of the conductor than in the case of the insulator. Where the insulators are confined to suspension position, except for a few points on the line there is little to be feared from vibration unless a design of poor balance is used. With increasing tensions and size of the conductor, it is quite likely that trouble from vibration may necessitate a halt in this direction. Even if tensions are lower or limited in the conductor, this need not seriously affect the economies of the line, as many engineers claim that a line having lower tensions and greater sag is no more expensive than one having a small sag and higher tension. This assumes that with the lower tension and greater sag in the conductor a lighter and higher tower may be used without increasing the cost, which is a most important point. Small sags and high tensions may readily limit the size of conductor due to vibration, so that excessively large insulators may not be necessary. With higher towers and greater sag, larger conductors may be used, and this in turn might necessitate higher strength in the insulators than in the case of small sags. This, of

course, is assuming that the length of span is the same and that vibration is the limiting factor on the conductor with small sag.

The Amount of Power Which May Be Carried Over the Circuit

The amount of power which may be carried over the circuit will tend to limit the size of conductor probably more than any other factor. Where the transmission distances are long a frequency less than sixty cycles may be necessary to make the long line an economic success.

If frequency, charging current or line reactance is a limiting factor in the amount of current that may be sent over a circuit, it is possible that we may not have very much larger conductors for some time to come. The amount of current that will flow into a short circuit is likely to have some bearing on the type of insulator that may be used. Where the short-circuit currents are large, the destruction may be serious, even though the short exists for only a few cycles. It is necessary to have insulators with fittings large enough that the heat generated will not cause them to be so weakened that they will drop the line. In general, however, this need not necessarily affect the mechanical ultimate in the insulator itself, for attention need be given only to the size of those fittings that are likely to conduct current in the case of a short or in case the arc blows through the insulator string.

The danger of damage to insulator strings from heavy arcs to ground will probably be a more important factor in determining the mechanical ultimate of the insulator in the future than at present. Where multiple strings or yoke arrangements are used, the clearance in the tower cannot be used to such good advantage and the difficulty of raising the flash-over between conductor and ground for severe line conditions is greatly increased. From this it follows that even though multiple strings could be used, the tendency will probably be to use a single string in order that a high flash-over voltage be obtained as readily as possible to eliminate arcs to ground.

To be a financial success, the heavy line must have a high degree of reliability. The tower which makes the problem of preventing flash-overs easy is likely to be poor from the mechanical standpoint. There is good reason to believe that this will have considerable influence on the heavy trunk line of the future where the flash-over to ground is the most serious problem.

Tower designs which facilitate the problem of obtaining high flash-over voltages are likely to be weaker mechanically. The tower with a narrow face opposite the conductor, longer arm at the top or greater vertical spacing to offset braces or longer arms below will not be as strong for a given cost. As the electrical field set up by the tower must be given careful consideration in order to eliminate the increasing damage due to flashovers, it is quite likely that the mechanical limitations of the tower may limit the load for the insulator. In the past towers have been designed more for mechanical considerations, but the time has arrived where much attention must be given to the effect of the design in causing flash-overs from the conductor under operating conditions.

The line which is more or less flexible imposes less severe conditions on the insulators and towers and probably has the greatest reliability for severe mechanical loads. Where sleet conditions are very severe, a line may be constructed in two ways. In one case, small sag with high tensions and frequent dead-ending may be used to limit the sag in the conductor due to sudden changes in loading. This, of course, imposes severe conditions on the insulator compared to the line that has greater sag.

A change in load in adjacent spans will not affect the spans having large sag as much as the spans having small sag. By making use of this fact it is possible to use suspension insulators, whereas otherwise dead-end insulators might be deemed necessary.

Consideration of these things indicates that there are various conditions, part of which tend to increase the load on the insulator and part of which tend to make the duty on the insulator less. In 1908 and 1909 insulators were designed and made up having ultimates from 8,000 to 35,000 lb. The average suspension line in 1909 and 1910, even where the conductor was probably not greater than 2/0, called for dead-end insulators having ultimates of from 12,000 to 14,000 lb. and suspension insulators having ultimates of 10,000 lb. Today there are many lines using suspension insulators which have an ultimate of from 8,000 to 9,000 lb., although the conductors may have an ultimate of from 15,000 to 20,000 lb.

The present tendency in heavy catenary lines where the tensions are exceedingly heavy is to use insulators which have a lower ultimate, but have more provision for thermal stresses than was formerly the case.

Reliability of Line Essential

The cost of the insulator is too small a part of the system and far too vital to attempt to make a saving by using an insulator of lower ultimate where one of higher ultimate would give better results, even though the cost were greatly increased. It is well to take into account the limitations as to design and manufacture of high-strength insulators in the mechanics of the line and the general layout. It is a comparatively easy matter to make an insulator that will withstand a very heavy mechanical load or test. By mechanical load or test is meant load at which the dielectric is still good. In practice, however, this insulator may fail after a few years' operation owing to thermal stresses or a combination of stresses.

High test values may be very misleading in the future as in the past unless great care is taken to offset distortion and thermal stress, particularly for insulators of high strength.

Link insulators are difficult to manufacture for high ultimates owing to the shearing and thermal stresses set up in the porcelain. Due to the separation of the metal, it takes less burning to drop the line. In the cap and pin insulator high tensions in the insulator necessitate large enough bearing surfaces and grading of the stress so that the dielectric will not fail in shear or combined shear and tension, or due to the distortion of the dielectric.

If other factors of design are maintained the same, the problem of counteracting the distortion for the metal parts tends to increase at a considerable rate. If the cap thickness is maintained and the same loading per square inch on the inner surface is used, the cap distortion tends to increase as the square of the ultimate or load placed on the insulator. Owing to the necessary strength in the dielectric required to take care of the dielectric stresses in the smaller insulators, this is not noticeable until insulators of a large size

are desired. There is a strong tendency to offset this factor by using a very thin dielectric so as to keep the diameter of the cap small. Insulators of this kind make a much better relative showing, but in general the danger from vibration is very much increased.

Distortion Effect on Cap and Pin

The question of cap distortion or reaction as well as that of the pin is a very old problem. This distortion may be taken care of in several ways, but is a difficult matter fully to compensate for it without materially increasing the cost over present types of insulators or embodying features that will not stand the test of time.

The distribution of stress on the inner surface has been greatly improved by the use of the resilient pin, which may be made up in many forms and to develop practically any desired stress. The problem is comparatively simple here, as a pin may be made which is truly a resilient member and will restore itself to initial position with a reduction in the load. Where pins of this type are used, however, it must be remembered that they do not form the best combination when built to obtain high test values, as the thermal stresses will be increased. However, since the steel may be uniform in quality, it is possible to work this on a narrow margin. In other words, if an insulator will be subject to a maximum load of, say, 6,000 lb., it may be advisable to use bearing surfaces on the cement which could be developed for test purposes to, say, 18,000 to 20,000 lb. It must be remembered, however, that a stress of 20,000 lb. or probably less per square inch on the metal will reach the theoretical ultimate of the adjacent procelain owing to the elastic stretch in the metal. From a thermal standpoint, it is advisable to keep the section of metal down. If, however, a high load is placed on the insulator for a considerable length of time, which will cause too high an elastic stretch, the dielectric will be spoiled. If it is known that high loads must be carried, ample sections must be provided, even though they develop high thermal stresses.

Of course it is possible to compensate to a very large extent from the standpoint of the design of the pin. In the case of the cap, however, the problem is somewhat more difficult. In general, the highest mechanical loads occur at low temperature. Since the caps have a higher linear coefficient of expansion for temperature changes, the low temperature tends to cause the cap to contract, and this tends to offset the increased load placed on the insulator. It is exceedingly difficult, however, to take care of all of the different conditions. If a high tension is applied at a high temperature, a cap may be stripped unless the initial tension is rather high. One method of offsetting the cap reaction is to assemble at high temperatures. Where this is done, however, the cap tends to contract at low temperatures and causes a shearing of the porcelain in the head, particularly if the load is light. Caps or heads which slip and wedge can be used to compensate for very heavy loads. In general, if a heavy load is once applied to the insulator, the wedging method of compensation tends to maintain a radial component on the head, even if the tension is relieved. Probably the most serious objection to this method of treatment is the danger of the cap or pin adjusting itself in operation. The sudden slip where a long stretch of high-strength conductor is attached may set up a mechanical surge which will magnify the tension in the line. Unless a very ample margin is provided, the cap may be split or the high radial component may tend to shear off the head should the load be taken off.

There are other methods, of course, for compensating. Whether or not these are necessary depends more on the conditions which are to be set up in the future than at the present time. Greatly improved types of insulators may, of course, be made by using metals which have coefficients of expansion more nearly the same as that of the porcelain or by restoring the stress by resilient means so that the dielectric in an insulator will have to withstand stresses only during heavy load conditions.

Thermal stresses are present in the insulators on any line regardless of load, and if overlooked trouble is likely to follow, even though the insulators show up to very good advantage in mechanical tests.

Tests at high loads, like insulator specifications, are not a very safe guide as to long time performance. The resilient or coated sanded surface greatly increases the life of the average insulator, but it cannot overcome large distortion in the attached metal. If loads in excess of 10,000 lb. are to be carried for long periods of time, a high degree of refinement is essential if certainty of performance is to be insured.

A greatly improved condition may be provided by keeping the thermal stresses down. In general, this requires lighter metal parts. Where light metal parts are used, however, they cannot be materially overloaded without distorting the metal to the point where the dielectric will be cracked.

This compromise between working load, test ultimate and thermal stress should require more thought in insulators as put out at the present time if long life and a high degree of reliability are to be obtained.

Oceanic Cable Transmission Studied in a Laboratory

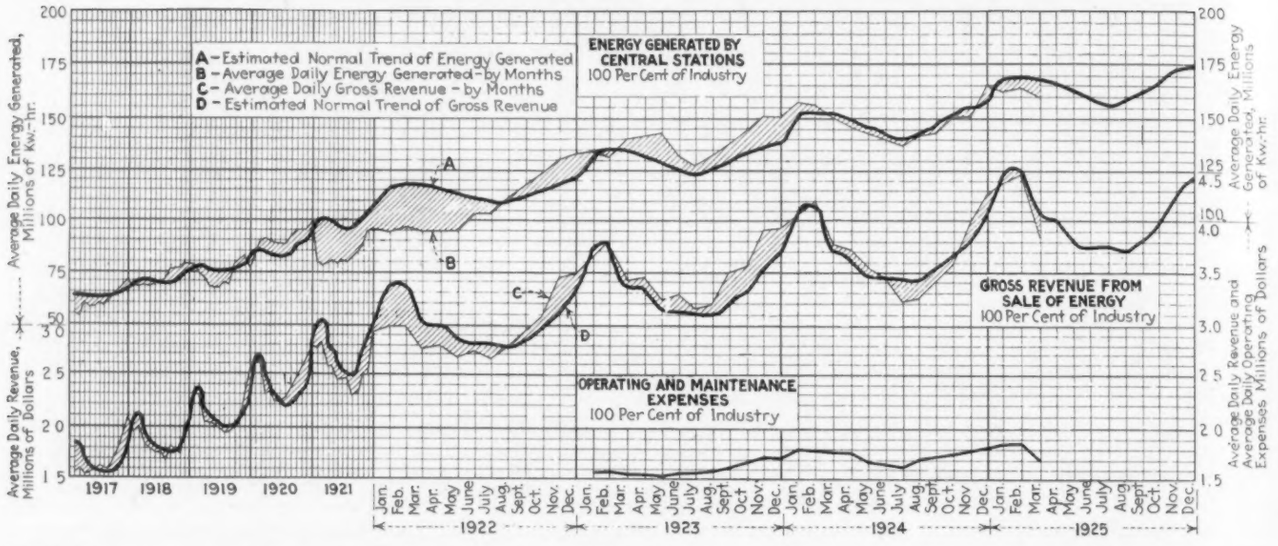
CROWDING 3,000 miles into twenty-four inches for the study of transoceanic cable transmission has been accomplished in a new type of artificial cable developed in the electrical research laboratories at the Massachusetts Institute of Technology.

The laboratory cable, which was designed by Dr. Vannevar Bush, professor of electric power transmission, is suspended in a glass container less than 24 in. square in which aluminum plates are suspended in a solution. In this "chemical ocean" of a few quarts transmission conditions encountered in a submarine cable 3,000 miles long can be accurately reproduced.

Connected to the condenser plates are sixteen terminals arranged on a narrow operating panel above the container. These terminals may be considered as mileage points on the cable. Varied conditions of transmission are reproduced by the introduction of loading or induction coils, and engineers are able to study what happens to a cable message when it flashes on its long voyage under the sea.

The electrolytic cable was developed for the purpose of studying means of increasing the speed of cable transmission, the outstanding problem in cable operation today. At present the signal impulse sent through a cable requires approximately one-hundredth of a second to cross the ocean, but it is about one second before enough of the impulse has flashed through the circuit to register on the receiving instruments.

March Output 8 per Cent Over Last Year


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – by Months
C – Average Daily Gross Revenue – by Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
1917 1918 1919 1920 1921
1922 1923 1924 1925

THE amount of energy generated by the electric light and power systems of the country totaled 4,962,338,000 kw.-hr. during March, a daily average of 160,100,000 kw.-hr., or 8.0 per cent, over March of last year. The energy generated during the first quarter of the year totaled 14,681,847,000 kw.-hr., a gain of 5.9 per cent over the output reported for the first quarter of 1924. If this rate of increase is maintained through the year, the total output of the electric light and power systems of the country during 1925 should be 57,750,000,000 kw.-hr., against 54,523,000,000 kw.-hr. in 1924.

The gross revenue during March totaled $119,500,000 and the operating expenses totaled $53,100,000. A detailed discussion of the financial operations of the industry will be found in the Financial and Corporate section of this issue.

A careful revision of the normal trend in the output and gross revenue of the electric light and power industry has been made and the accompanying chart corrected accordingly. In making this revision operating data for five-year periods were included, using the method of long-time trend and seasonal indices obtained by the method of link-and-chain relatives. The details of this computation are available to any one interested in the subject. The revised trend indicates that during March the output of the industry was 5.2 per cent below the estimated normal for the month. The industry operated at close to normal from February to December of last year, dropping below the normal trend in January of this year, which subnormal activity was continued through March. During March the gross revenue of the industry was about 4.8 per cent below the estimated normal.

TABLE III—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Energy Generated				Fuel Consumption		
	Hydro Plants		Fuel Power Plants				
	Thousands of Kw.-Hr.	Per Cent	Thousands of Kw.-Hr.	Per Cent	Coal (Short Tons)	Oil (Barrels)	Gas (Thousands of Cubic Feet)
January	1,676,536	32.8	3,445,240	67.2	3,230,153	1,329,855	2,898,225
February	1,718,745	37.4	2,878,988	62.6	2,722,559	854,162	2,457,897
March	2,009,243	40.3	2,953,095	59.7	2,762,345	792,595	3,228,726
First quarter of year	5,404,524	36.8	9,277,323	63.2	8,715,057	2,976,612	8,584,848

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES (100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly			Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Distribution of Energy Generated								Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
						Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
January	5,121,776	4,792,704	6.8	4,133,776	3,867,704	1,168,000	1,118,000	2,429,776	2,225,704	536,000	524,000	988,000	925,000	760,000	712,000
February	4,597,733	4,465,858	3.1	3,709,733	3,604,858	1,044,000	1,000,000	2,180,733	2,114,858	485,000	490,000	888,000	765,000	745,500	663,000
March	4,962,338	4,595,960	8.0	4,004,338	3,707,960	1,123,000	1,123,000	2,345,338	2,060,960	536,000	524,000	958,000	888,000	768,000	704,000
First quarter of year	14,681,847	13,854,522	5.9	11,847,847	11,180,522	3,335,000	3,241,000	6,955,847	6,401,522	1,557,000	1,538,000	2,834,000	2,578,000	2,273,500	2,079,000

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES (100 per Cent of the Industry)

Month	Gross Revenue from Sale of Energy			Operating and Maintenance Expenses			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1925 Thousands	1924 Thousands	Per Cent Increase	1925 Thousands	1924 Thousands	Per Cent Increase	1925	1924	1925	1924	1925	1924
January	$135,000	$120,800	11.7	$56,200	$52,200	7.6	45.3	47.0	26.0	24.6	43.4	43.0
February	124,800	116,500	7.1	52,200	50,700	3.0	42.9	45.7	30.9	27.1	40.3	44.0
March	119,500	111,400	7.2	53,100	49,500	7.2	43.0	46.0	30.0	28.0	39.0	42.0
First quarter of year	$379,300	$348,700	8.7	$161,500	$152,400	5.8	43.7	46.2	29.0	26.6	40.9	43.0

Features of Valmont Station

New Plant of Public Service Company of Colorado Built on Artificial Lake—Pulverized Fuel Used—Mechanical and Electrical Design Details—New Transmission Lines Constructed

By R. F. THRONE and W. D. HARDAWAY
Public Service Company of Colorado

THE Public Service Company of Colorado serves several cities separated widely, of which Denver is the largest. The load center of the system is about six miles northwest of Denver and the major transmission system is a 90-kv. loop, as shown on the accompanying diagram of the system.

The load growth of the system demanded further generating capacity and some unusual problems were encountered and solved in finding a practicable site for the new Valmont station recently built to care for the increased load. Existing steam plants could not be enlarged, because of lack of circulating water, and there were found no water-power sites capable of commercial development within 150 miles of Denver. A study of rivers in the district showed that even the Platte, the largest river, could not provide circulating water for a steam plant of more than 25,000 kw. without recirculation. For this reason a stream flow plant could not be considered as a possibility.

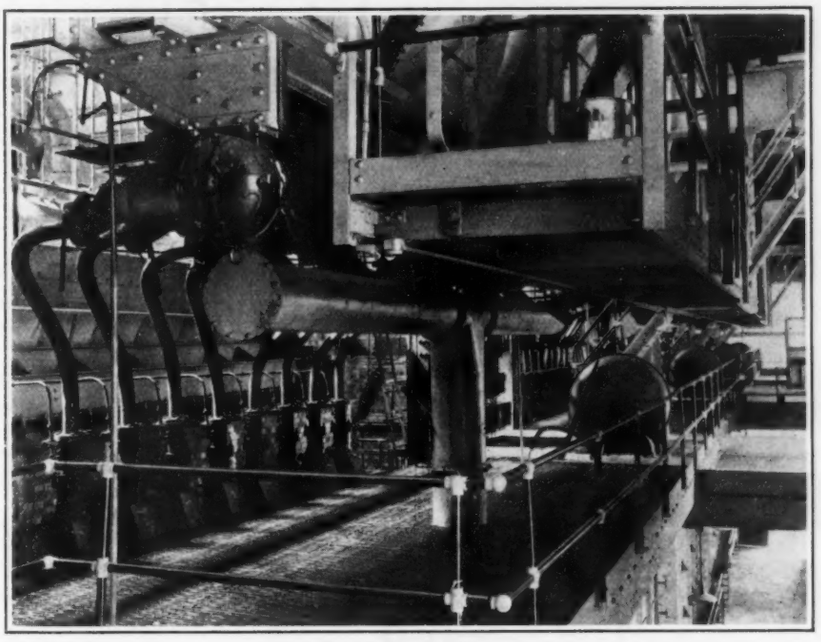


FIG. 1—STATION BOILER ROOM OPERATING GALLERY AT LEVEL OF PULVERIZED FUEL BURNERS

It then became necessary to study the possibilities of a plant operating on either a spray pond or a cooling tower and in addition the problem of getting a make-up water supply. An analysis of Colorado streams showed a very low flow for ten months of the year and flood conditions during May and June, when the snow melts on the mountains. It became necessary to build a reservoir to retain sufficient flood waters to run the proposed plant through the year and therefore there would be no advantages and several disadvantages in using a spray pond or cooling tower plant.

The direct stream flow of Colorado rivers is used for irrigation purposes and the waters of the Platte River may at times be entirely diverted for the water supply of Denver; hence many elements entered into the determination of the reservoir site. The site ultimately selected was one at which the flood waters of Boulder and South Boulder creeks, which had been previously wasted, could be used to fill Valmont Lake. These waters could then be used for irrigation purposes in the summer months and water could be conserved in the Nederland reservoir for use at the Boulder hydro plant.

Natural Radiation Used

A reservoir sufficiently large to care for future power demands was desirable; also it must be sufficiently large to carry over periods when no water is available in the streams. This made it advisable to eliminate the pumping head required with cooling towers or spray ponds and to depend on natural radiation for cooling. A thorough study was made of the heat-radiating capacity of an acre of water and the losses due to natural and forced evaporation.

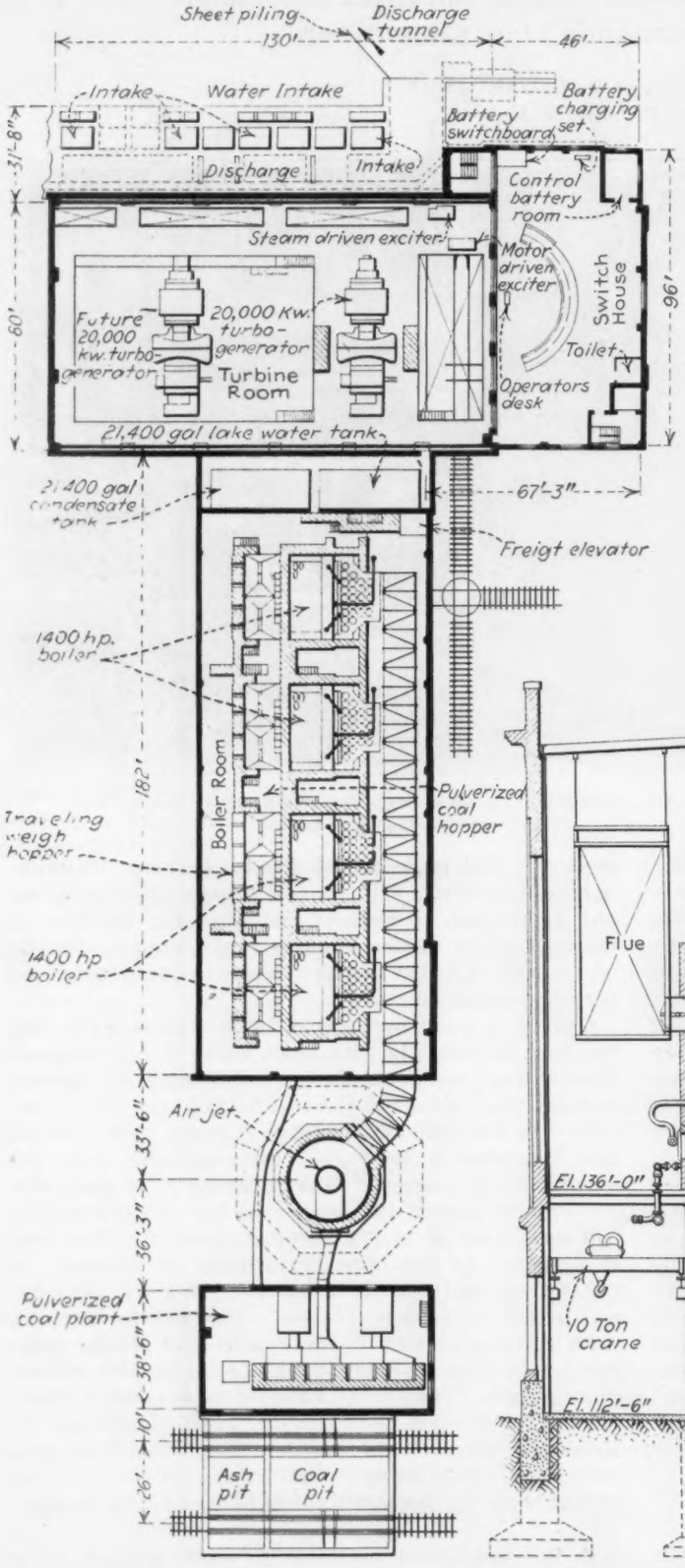
Out of a large number of lakes considered within the load district, the site near Valmont was selected. This site, which is twenty-six miles north of Denver, permits ready access to the coal fields of northern Colorado over two different railroad systems. The sub-soil also furnished a very good reservoir site from the standpoint of seepage. The topography is such that the present lake of 120 acres area can be increased to 540 acres area of 11,162 acre-feet capacity. This area is sufficient to care for an ultimate development of 200,000 kw. on the basis of 400 kw. per acre. This figure is felt to be conservative. The site is within a short distance of both South Boulder and Middle Boulder creeks, hence supply ditches need not be of any great length. The site at Valmont gave a water reservoir of 11,162 acre-feet capacity, which duplicates the Nederland reservoir in Boulder Canyon on the same watershed. This latter reservoir was installed in connection with the Boulder Canyon hydro-electric development.

It was not found desirable to locate a plant at a mine mouth. The production of coal from the northern Colorado soft coal fields is primarily to provide for the

domestic demand. This demand is highest during the winter and very low during the warmer months. Subbituminous coal is soft, breaks up very readily and therefore each two tons of mine run coal hoisted produces one ton of slack and one ton of marketable coal. As the demand for this slack is secondary it is a much better choice to have the plant so located that greatest advantage can be taken of surplus slack from the many mines operating. As water is plentiful at the hydro station due to melting snows during the summer months, with the system load less than in winter, generation with steam is carried out at a very low load factor in the summer. Therefore the demand for generating coal follows the demand for domestic coal, with the result that only a small percentage of mine-run coal need be considered and that only during the warmer months, when much less coal is being burned.

Incidentally the construction of the plant at the location chosen allowed the plant to be built on dry land and later placing the water around it. This was actually done, the lake being drained out for irrigation uses during the construction of the intake structures, thereby eliminating all under-water work. Consequently intake structures for five units were built, as it will never again be possible to drain the lake for similar purposes.

Circulating water is drawn from the bottom strata of the lake and after passing through the condensers is discharged into a common discharge tunnel. This tunnel now discharges back to the lake at the west end of the plant. In order better to disperse this discharge water over a wide area



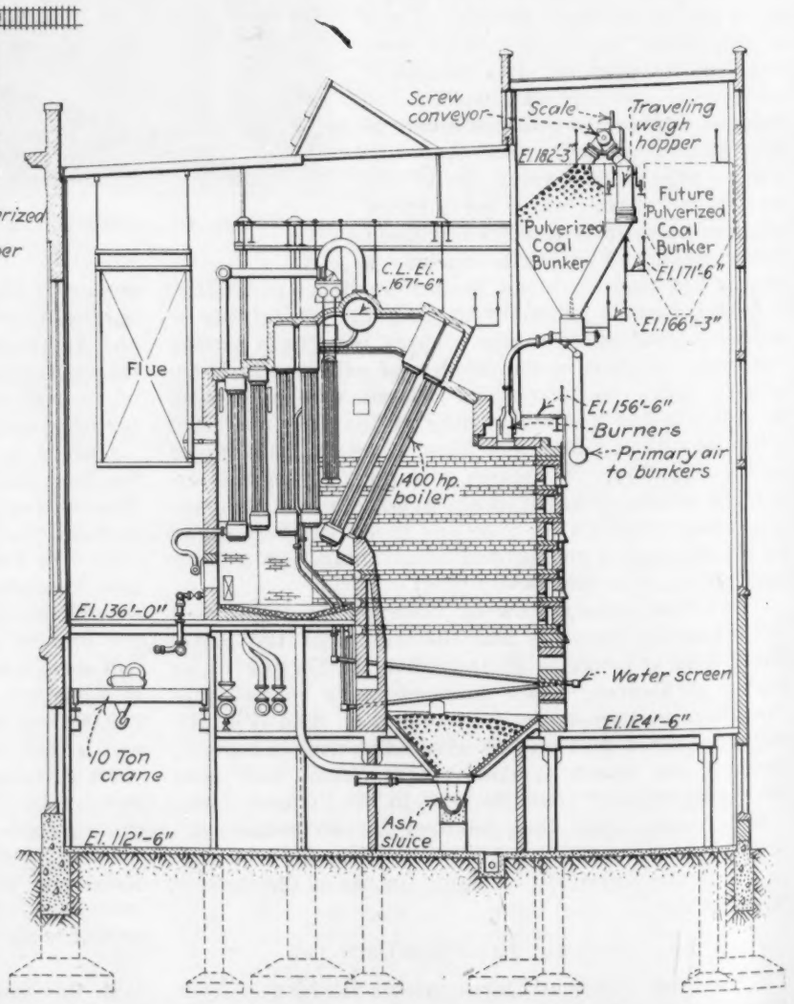


FIG. 2 (AT LEFT)—GENERAL PLAN OF VALMONT STATION. FIG. 3 (AT RIGHT)—CROSS-SECTION OF BOILER IN VALMONT STATION

a pier has been built extending out into the lake. This plan will care for three of the ten generating units that comprise the ultimate lake development. The circulating water will then discharge across the peninsula that will be formed to the other arm of the lake, thereby requiring a path of about three miles to be followed before it again arrives in the plant.

FUEL HANDLING AND BURNING

Choice of fuel-burning equipment was based upon, first, ability to burn Colorado sub-bituminous coal, and second, ability to pick up sudden increases in load often ranging from floating load to full generation capacity. Experiences with every other type of fuel-burning equipment from hand-fired grates to the most recent underfeeds and forced draft chain grates proved that Colorado soft coal cannot be burned with low ash pit losses and realize above normal boiler ratings. Underfeed stokers proved their capability to accelerate at the rate of 100 per cent per minute, but their operation was at the sacrifice of operating economy.

Though requiring a higher initial investment, after properly weighing all considerations, pulverized fuel-burning equipment was selected for the boiler room. In the turbine room the turbine bleeding feed-heating cycle was employed. Coal originating in surrounding mines within a radius of ten miles has the same general characteristics, differing chiefly in moisture and ash proportions. Typical analyses are given in Table I. Often attractive offers are available on coals that become a drag on the market and advantage can be taken when fuel-burning equipment is flexible.

Coal cars arriving at the plant are spotted over a concrete receiving pit. Should the car not be equipped with dump bottoms, the coal-unloading crane on top of the preparation house will unload the car by means of a clamshell bucket. Otherwise it will be dumped into the pit, from where the clamshell will elevate it and discharge the coal into a receiving hopper mounted on the tower. This hopper is located over a short belt conveyor equipped with a magnetic roll which removes all tramp iron as the coal is fed to the two-drum crusher. The crushed coal then falls to a 650-ton storage bin inside the preparation house. Four Wood type driers are bolted to the bottom of the storage bin, each provided with coal gates to allow the emptying of a drier. Gases for these driers are taken from the base of the radial brick stack and after passing through the driers and the drier fan are discharged through separate stub stacks through the roof. The mills take coal directly from the driers and after being ground it is elevated to the cyclones located at the top of the preparation house. Motor-driven fans provide the circulating air for the regulation of fineness of the coal and to elevate the prepared coal to the cyclones.

Screw conveyors remove the powdered coal from the cyclones and deliver the coal to the boiler bins. Each conveyor, the one relaying to the other, is electrically interconnected with the other as well as with the pulverizing equipment, so that the interruption to electrical energy of any equipment will also stop all other equipment furnishing coal further down in the cycle. Storage of pulverized coal to the extent of forty tons is provided above each of the 13,320-sq.ft. Bigelow-Hornsby boilers. Four duplex feeders mounted on the bottom of the bins deliver coal to the eight fantail burners. At the discharge of each feeder screw, primary air at a pressure of 16 to 20 in. is admitted.

The rate of feeding coal is under control of variable speed direct-current motors. The controls are so arranged that all feeders can be varied in unison or any particular feeder separately adjusted. This feeder control is located on the boiler control panel together with instruments recording and indicating the boiler performance. Gages provided for this purpose consist of one boiler meter recording the steam output, air flow through the boiler unit and flue gas temperature; one steam-pressure recorder combined with one steam-temperature recorder such that when full superheat of 200 deg. exists at normal pressure of 375 lb. the two records will combine. A multipointer gage indicates the four feeder speeds, furnace draft, uptake draft, primary air pressure and the rate of flow of feed water through the two feed pipes to the boiler unit (see Fig. 5).

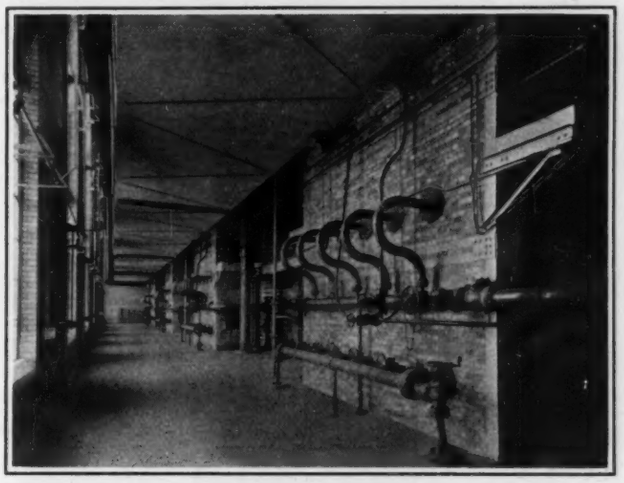


FIG. 4—THE FRONT OF THE BOILERS IN THE VALMONT STATION

TABLE I—TYPICAL COLORADO COALS

Mine	Columbine	Puritan	Monarch	Simpson
Seam				
Moisture	21.66	25.74	19.25	26.58
Volatile	31.84	31.87	33.28	32.79
Fixed carbon	41.97	38.71	40.74	42.54
Ash	4.53	3.68	6.73	4.09
B.t.u. per pound	9,793	9,340	9,587	9,872
Sulphur	0.26	0.38	0.31	0.75
B.t.u. dry basis	12,500	12,575	11,870	12,428
B.t.u. on moisture and ash-free basis	13,300	13,280	12,990	13,195

PULVERIZED FUEL FIRING DETAILS

Coal is fired through the roof of the furnace through fantail burners set vertically and at right angles to the front wall. Secondary air is admitted into the furnace through ninety-six openings 7x9 in. in size. These openings are arranged in six zones, each zone receiving air under spring-controlled dampers set in the side walls and the rear of the bridge wall. Boilers are set so as to provide a furnace height of 28 ft. 8 in. from the ashpit to the burner and 23 ft. 9 in. from the water screen to the burner. Furnace inside width is 22 ft. and depth is 16 ft. This allows a gross furnace volume of 10,288 cu.ft. and a net volume of 8,160.

Boiler setting is built up of firebrick embodying hollow side walls, being tied back by means of block tile to extension steelwork serving as buckstays. The inner wall is 9 in. thick and the outer wall varies from 13½ to 9 in. thick, leaving an air space varying from 14 to 18½ in. wide. Hydraulically operated ash gates discharge ashes from the pits to the sluiceway. Combus-

tion ashes settling out in the rear part of the boiler are washed out to the ash sluiceway below.

Each boiler consists of 13,320 sq.ft. heating surface, of which 10,730 sq.ft. is allocated to the boiler section and 2,590 sq.ft. to the integral economizers. Boiler sections are arranged in rows containing the following

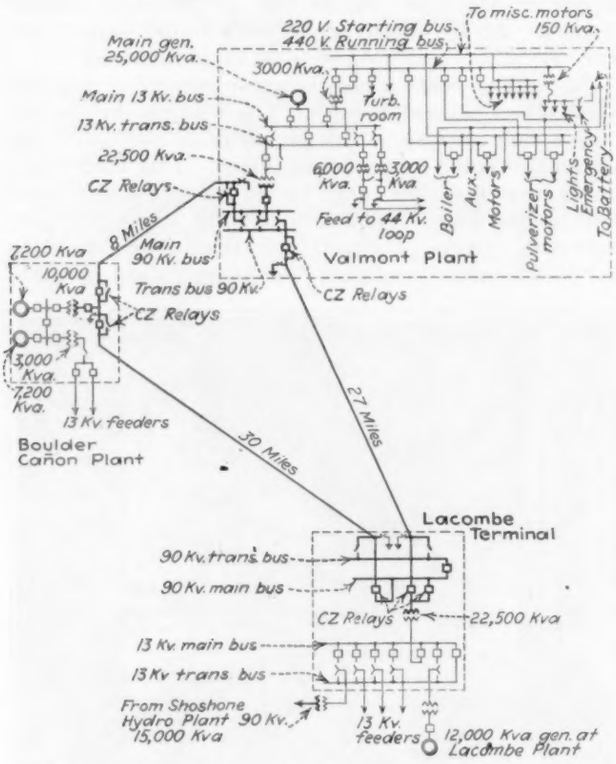


FIG. 5—SIMPLIFIED DIAGRAM OF THE VALMONT STATION AND THE 90-KV. LOOP OF THE PUBLIC SERVICE COMPANY OF COLORADO

number of units: Nine, nine, nine, seven, five, five. This arrangement tends to maintain gradually increasing gas velocity through the boiler unit. The steam is superheated, using a Foster superheater of 6,288 sq.ft. area located in rear of the front bank of units.

Boilers are supplied with feed water from either or both of two feed lines. This water is admitted into each end of a header serving each boiler, from which five 2-in. supply pipes deliver water to the economizer sections. Feed water enters this feed header through feed-water-regulating valves.

Each of the four boilers discharges steam into one main steam header serving the main turbine unit. Before entering the turbine room an anchored cross is provided, from where steam for auxiliary use is taken. The other side of this cross will allow cross-connection to other boiler unit additions. A system of header drainage has been used, which also serves as a portion of the auxiliary steam header. This arrangement allows the operation of auxiliary equipment by any one boiler should it be necessary when the main steam header is killed.

TURBINES AND HEAT BALANCE

At present one 20,000-kw. turbo-generator is under load. This turbine is a 25,000-kva. Westinghouse Bauman type of turbine and is connected to a 30,000-sq.ft. surface condenser. Building space allows the installation of a second unit before it will be necessary to extend the plant buildings. Steam is bled from three of the four points provided to heat the feed water back up to 300 deg. F. As the plant must carry loads which fluctuate rapidly an open feed-water system is provided. Surge tanks are provided so that storage can be taken or used at times of sudden load changes (see Fig. 2).

Condensate is pumped directly from the condenser hot well to the high level surge tank. This tank also receives the make-up water and the drain from the low-pressure and intermediate stage heaters. The drain from the high-pressure stage heater is discharged into the feed pump suction header or into the low level surge tank, depending on the operating pressure in the heater as determined by the load.

COOLING ARRANGEMENTS

Water as required for cooling purposes flows from the high level tank through the turbine bearings, oil cooler and transformer-cooling coils and discharges into the low level tank located in the basement. From this point it is picked up by the low level tank pumps and discharged to the high level tank, bypassing such water as may be required for boiler feed, which after passing through the air ejector condensers, 140 deg. and 200 deg. stage heaters is discharged into the de-aërator.

The 200-deg. heater serves as a regulating heater under the control of a thermalstatic regulator such that the outlet temperature when combined with the amount of steam available in the de-aërator will maintain a uniform temperature at this point of 206 deg. This temperature is taken as the controlling temperature for proper de-aëration of the feed water.

The feed pumps draw upon the storage of de-aërated water in the de-aërator and pump through the 55-lb. bleed heater and then to the boiler units. Feed pumps are steam driven, while all other auxiliary equipment is normally electrically driven.

Circulating water equipment consists of two bi-rotor centrifugal pumps, one motor driven, the other duplex driven by steam turbo gear and motor. Each pump is rated at 18,000 g.p.m. and operates at 490 r.p.m. Condensate is removed by either of the two centrifugal pumps, one of which is motor driven, the other steam turbo driven. Air removal equipment consists of a Duplex bank of steam air pumps and also a motor-driven Le-Blanc air pump. The normal plant operation consists of all motor-driven auxiliaries except the feed pumps, yet the steam-driven equipment is sufficient to permit operation should system disturbances affect the station source of supply when the turbine unit is out of service.

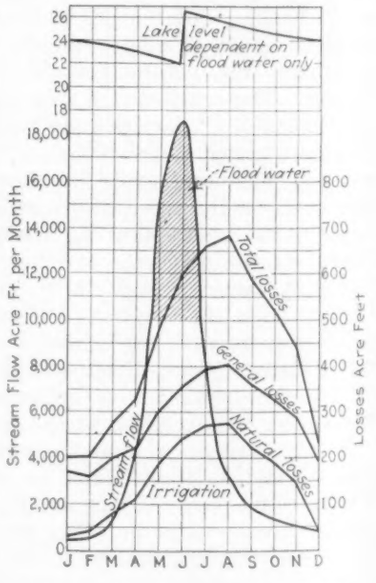


FIG. 6—ESTIMATED FACTORS ON ULTIMATE LAKE DEVELOPMENT

Some effort has been made to insure a steady flow

of energy from the plant, as the following notation will show. Two railroads serving many miles supply the plant. The plant has a locomotive crane with a boom sufficiently long to permit it to place coal in the main bunker of the preparation house in the event that the main crane breaks down. There are four pulverizing mills duplicate coal conveyors, multiple-feeder units on each boiler. One of the primary air fans on the pulverized coal feeders has been equipped with dual drive.

Four boilers allow for plenty of capacity with one out for repairs. Feed pumps, circulating water pumps, condensate pumps and exciters are all in duplicate. The plant is connected to two loop circuits, the 90-kv. loop transmission serving Denver and the 44-kv. loop transmission serving the several cities of northern Colorado.

The plant is particularly fortunate in having a very good supply of make-up water for boiler feed. A connection for this purpose was made to the mains of the city of Boulder. This community obtains its water from a melting glacier and diversion is made before the water has passed over anything more than granite rocks. This accounts for the absence of evaporators or feed-water-treating systems.

ELECTRICAL FEATURES OF INSTALLATION

The main turbine drives a 25,000-kva., 13,800-volt, three-phase, sixty-cycle, star-connected alternator which has an ungrounded neutral. The 13,800-volt switching equipment is located in a switch house at the end of the turbine hall. All incoming and outgoing leads enter the switch house through the first floor, and consist of single conductor, varnished cambric insulated cables in fiber duct cast in concrete slabs. The outgoing leads and control circuits for the outdoor equipment leave the switch house through a cable tunnel built above grade through the outdoor switch yard.

As may be seen from the line diagram, the conventional grouped phase arrangement of a main and synchronizing bus was used. Both buses are located on the third floor of the switchhouse. Three-pole, 25,000-volt oil circuit breakers are used for all 13-kv. switching. At present no load limiting or synchronizing reactors are installed, but space has been provided for them in the first floor of the switch house.

Excitation for the main unit may be supplied from either the direct-connected exciter, a steam turbine-driven exciter, or in emergencies from a 35-kw. motor-generator set and storage battery in parallel. Automatic voltage regulation is obtained by the use of a rheostatic voltage regulator, operating in series with the main field. This allows a constant voltage to be maintained on the exciter bus, and while it is somewhat slower than the contact-making regulator operating on the exciter field, it is less sensitive to system disturbances, and is believed to be more reliable.

The bench type switchboard is located on the fifth floor of the switch house. From this board are controlled the generator, 13-kv. breakers and outdoor 44- and 90-kv. oil switches. Private telephone lines to the system, Bell and intercommunicating telephones for the station and the turbine room signal system terminate in the control room. Control and signal conduit terminate in a "half floor" immediately below the control room. Access to this space is provided through a conduit shaft which extends the full height of the switch house.

As shown on the line diagram, house power is supplied from a bank of three 1,000-kva. transformers, located on the ground floor. This bank is large enough to carry the entire station load operating open delta. The transformers step down from 13,800 volts to 440 volts and 220 volts. The 220-volt connection supplies a starting bus only. All station auxiliary motors, including coal preparation and handling machinery, with the exception of the boiler feeder motors, are supplied

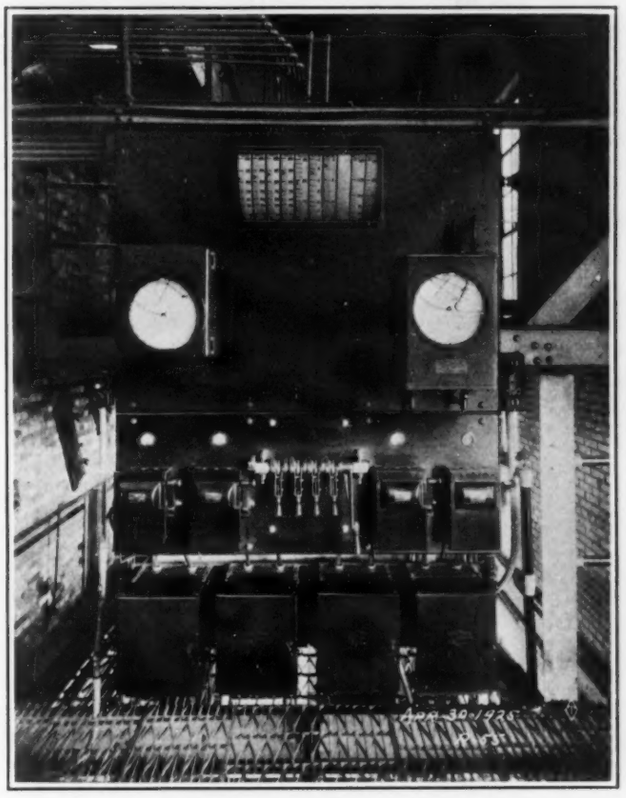


FIG. 7—BOILER CONTROL PANEL

from this bank at 440 volts, three-phase. Station lights are supplied through a bank of 440/220-110-volt single-phase transformers. The boiler fuel feeders are driven by 220-volt, variable-speed, direct-current motors, supplied by the station battery, which is located in a separate room.

Direct current for charging is normally obtained from a 35-kw. motor-generator set, but may be supplied by the turbine-driven exciter. Station lights are automatically thrown on the battery in the event of failure of house power. All auxiliary motors are push-button controlled and are provided with "stay put" starting buttons, so the motors will be automatically restarted after an interruption of the house power supply. The control board for the station auxiliaries is located in the turbine hall on the ground floor, just below the main turbine deck.

TRANSMISSION SYSTEM

Energy is distributed from the station through an outdoor transformer and switching substation at 44,000 and 90,000 volts, three phase. The two 44-kv. lines form a loop circuit approximately 125 miles in circumference, which supplies energy to nine substations in cities and towns of northern Colorado. These lines are supplied through one 3,000-kva. and one 6,000-kva., 13,800/44,000-volt transformer bank. The transformers are

star connected on the 44-kv. side, and are operated with the neutral solidly grounded.

The 90-kv. bus is supplied through one 22,500-kva. transformer bank, also star connected on the high-tension side, and with the neutral solidly grounded. Two outgoing 90-kv. lines are in service, one of which, twenty-eight miles long, connects the Valmont plant directly with the terminal substation two miles inside the limits of the city of Denver. The line inside of Denver was built on a private right of way purchased outright, and standard country towers were used except for one block. The other line, eight miles long, connects Valmont with the Boulder Canyon hydro plant, which is also connected to the Denver terminal by a thirty-mile, 90-kv. line.

The Valmont-Denver transmission line consists of 336,000-cm. aluminum cable, steel reinforced, on double circuit towers, with 12-ft. vertical spacing. The same conductor was used on the Boulder Canyon line, with single circuit towers and 14-ft. horizontal spacing. Seven 10-in. disk insulators are used in suspension strings, and seven 11-in. disks are used in dead end and semi-dead end strings. The maximum span is 2,200 ft. on the Boulder Canyon line.

The 44-kv. lines leave the station on double-circuit steel poles with pin type insulators. This double-circuit line is approximately three miles long; then the circuits separate, on a wood-pole sectionalizing tower, to form the loop described above.

The Denver terminal substation is located two miles within the city limits. No great difficulty was met in securing right of way for the 90-kv. line within the city and a route was found to a very desirable site, adjacent to a steam-generating plant owned by the company. An outdoor terminal substation was built and 90-kv. switching equipment and transformers were supplied. One 22,500-kva. transformer bank steps down from 90 kv. to 13,800 volts for transmission to city substations. The terminal substation is also the load-dispatching center of the system.

Loop Used to Secure Reliability

The lines from Valmont to Denver and from Boulder Canyon to Denver follow separate rights of way, and it was desirable that these circuits be operated as a loop, to prevent failure of either line from affecting the supply of power to Denver. Satisfactory relaying of this loop offered some difficulties, as generating equipment is located at the three sectionalizing points of the loop. Westinghouse type CZ relays have been installed for both line-to-line and line-to-ground faults. These relays require a source of potential which will be proportional to the line voltage during a disturbance. The expense of 90-kv. potential transformers would have been prohibitive, so the potential coils of the relays are supplied through compensators, from potential transformers on the low-tension side of the 90-kv. banks. The compensators are arranged to compensate the voltage impressed on the relays for the effect of current passing through the main transformers, and are adjusted to give to the relays a true proportion of the line-to-line and line-to-ground voltage at all times. The performance of the relaying system is being watched with particular interest, as this is one of the first installations of this type of relay on a loop that connects only generating stations.

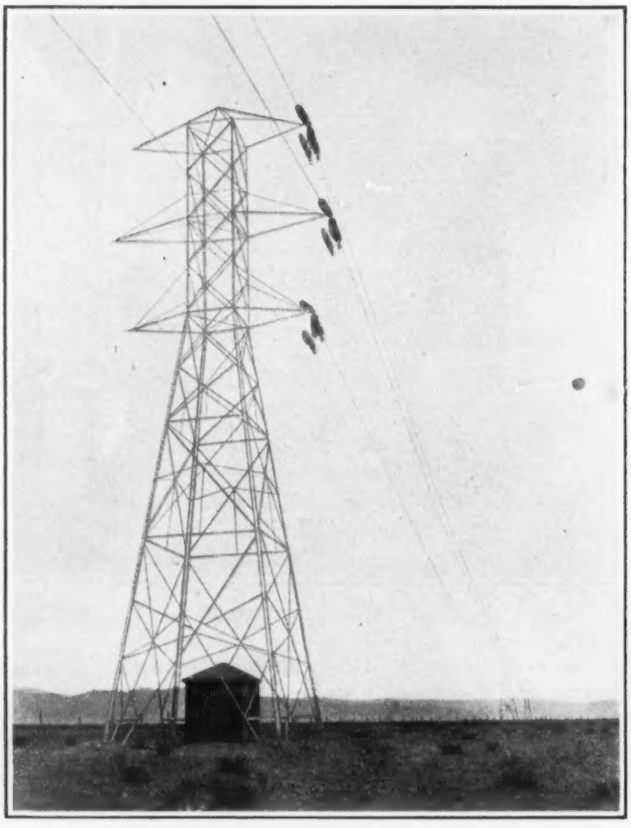


FIG. 8—VIEW OF VALMONT-DENVER 90-KV. LINE SHOWING SECTIONALIZING DISCONNECTS AND PATROL HOUSE

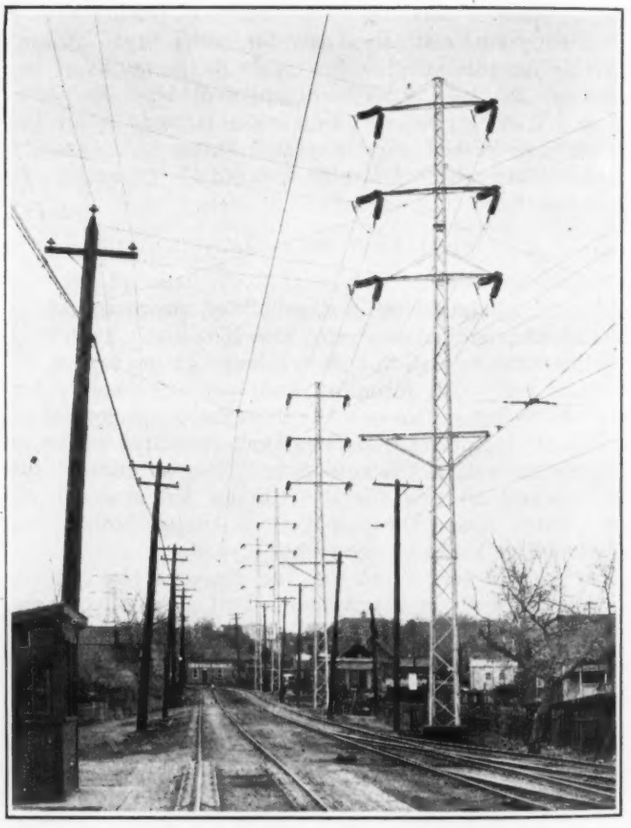


FIG. 9—STEEL POLE CONSTRUCTION USED ALONG RAILROAD RIGHT OF WAY IN CITY LIMITS FOR 90-KV. LINE

Takes Issue with "Giant Power" Report

Constructive Criticisms of Several Statements Regarding Utilization of Electricity in Agriculture—Rate Structure, Class of Service, Canadian Solution, Legislation for Extensions and State Contributions

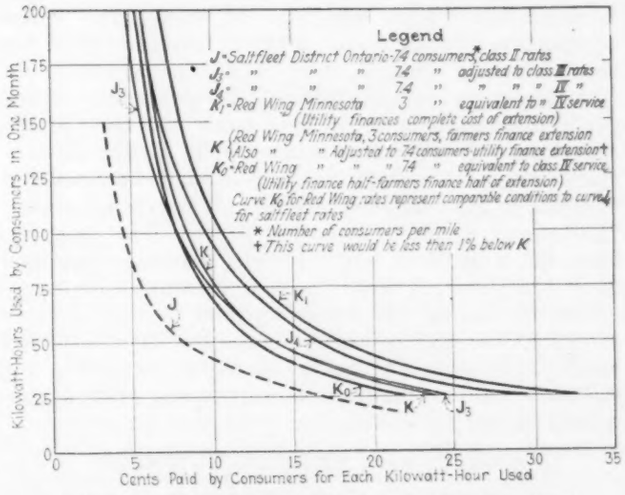
By PROF. E. A. STEWART
Department of Agricultural Engineering, University of Minnesota

ALTHOUGH the "Giant Power" report of Pennsylvania, recently issued, contains a great deal of valuable material regarding the utilization of electricity in agriculture, several statements are made which can hardly be substantiated by appealing to the experience of the fifteen or more unbiased state committees now engaged in the study of the relation of electricity to agriculture. Since the report will undoubtedly receive wide distribution there is all the more reason why discussions of disputed statements and conclusions should be extensively disseminated. As an offset to the impressions which have been or will be created by the report the writer will take up and discuss some of its statements obviously at variance with facts found in Minnesota as well as other states where the writer has had the frequent privilege to consult and exchange experiences with the principal workers in rural electrification.

Widespread experience is in thorough agreement with Prof. R. U. Blasingame's statement (Appendix B, page 255) that a great deal of research work must be done before rural electrification can be placed on an entirely successful basis; also, that the first requirement is a satisfactory rate structure. However, the general report of the director, Morris L. Cook, is apparently at issue with the fundamental requirements of rates. On page 41, second paragraph, Mr. Cook maintains that "rates . . . are largely based on . . . 'cost of service' and not on cost of power," adding that "this situation appears greatly to retard a healthy and balanced growth" and that "rural communities are not interested in the service demanded by city folks." Retardation of the use of electricity has not been caused by the fact that the cost of service determined the rate, but by the fact that most rates give the small user a big advantage and penalize the large user, tending to make all consumers small users of electricity. Rates for a small consumer will necessarily be based almost entirely upon the cost of service, because the cost of power is a minor item. This is true in city service and certainly much more so in rural service, the cost of service for the small user (20 kw.-hr. per month) in rural service probably being ten to twenty times as great as the cost of energy. However, if the rate is properly made so that all service costs are put in a fixed charge, then the rate per kilowatt-hour can be made low for the energy only. A rate of this type will not retard the use or growth of electricity in farming sections.

URBAN AND RURAL SERVICE

Regarding the service demanded by city people as contrasted with the dwellers in rural districts, the writer has no sympathy whatever with hay-wire outfits which will give class "C" or class "X" service to farmers. If electricity is to assist farmers in handling power problems, there must be continuity of service, quick attention to trouble calls, and the voltage variations cannot be excessive. The farmer must be able to depend upon electricity for doing work at the time which he sets aside for doing this work. If the voltage is not properly maintained, the farmers will have to use larger motors than are necessary. This was one of the biggest evils which grew out of the early uses of electricity for industrial purposes. The extra cost of oversize motors, the low power factor and the low load


Legend
J=Saltfleet District Ontario-74 consumers, class II rates
J2= " " " 74 " adjusted to class III rates
J3= " " " 74 " " " " IV "
K1=Red Wing Minnesota 3 " equivalent to " IV service
(Utility finances complete cost of extension)
K (Red Wing Minnesota, 3 consumers, farmers finance extension
Also " " Adjusted to 74 consumers utility finance extension+
K0=Red Wing " " " 74 " equivalent to class IV service
(Utility finance half-farmers finance half of extension)
Curve K0 for Red Wing rates represent comparable conditions to curve J for saltfleet rates
* Number of consumers per mile
+ This curve would be less than 1% below K
Kilowatt-Hours Used by Consumers in One Month
Cents Paid by Consumers for Each Kilowatt-Hour Used
0
25
50
75
100
125
150
175
200
5
10
15
20
25
30
35

COMPARISON OF MINNESOTA RURAL SERVICE RATES WITH THOSE IN ONTARIO

factor all demand that lines be built so that a motor can carry its full load or overload without causing trouble due to voltage drop. With the use of automatically controlled motors for pumping, refrigeration and so forth low voltage may have a serious consequence.

Referring to the problem of reaching farms with distribution lines, George H. Morse (page 134) states that "the Canadians have found an answer to this question." Canada has one way of doing it, California another, and many other states have other ways of doing it. Why should Canada's way be the answer? Is the service in Canada so much superior, or have any larger percentage of farms been electrified there than in our own states? An investigation will immediately show that a larger proportion of electrified farms exist in California and in many other places in the United States than there are in Ontario. Why not say that California has found an answer to this problem? Californians have certainly electrified their rural districts much more completely than Ontario and at the same time are providing electricity at a much lower average cost per kilowatt-hour.

Philip P. Wells (page 163), in discussing proposals for legislation, says: "Provision should be made for

the incorporation of rural electric districts upon the favorable vote of a sufficient majority of inhabitants and the owners of a sufficient majority of acreage." It is inferred that this statement is intended to suggest legislation permitting farmers to organize co-operative utility companies to purchase, distribute and sell electrical energy. This scheme has been tried in a great many states and in foreign countries, but when thoroughly studied has usually been condemned. Under such a plan the farmers assume all the responsibilities of a public utility company without having the facilities to handle them. The expert help that is required to take care of such properties cannot be readily obtained. The properties are not well maintained, and in most cases the service is poor. Furthermore, the liabilities attached to public utility operations are so great that many co-operative companies are sometimes very seriously embarrassed by damages from storms or by suits for personal injury. The advisability of the procedure suggested in the "Giant Power" report is very questionable, since it has not proved a success where it has been tried.

In another place (page 164) Mr. Wells advises state contributions toward the cost of rural lines where regions are conspicuously without service. This has been done in Ontario, but, like the formation of municipally owned and farmers' co-operatively owned public utilities, it is not in agreement with the average American way of doing things. The writer is very much in agreement with a statement made by President Coolidge in his inaugural address of March 4, namely: "The people declared that they wanted their rights to have, not a political, but a judicial determination, and their independence and freedom continued and supported by having the ownership and control of their property, not in the government, but in their own hands. Likewise, the policy of public ownership for railroads and certain electric utilities met with unmistakable defeat."

Analogy with Highways Untenable

Mr. Wells supports state contribution to rural electric service on the same basis as state aid for highways. The same principle is not applicable in any degree to rural-service lines. The state highway is not used alone by the few farmers who live along it, but by thousands and tens of thousands who live in other parts of the state and country. The rural electric line has an end like the stub road. It does not give through service. Its service is only for persons who are connected to the line. In fact, the stub road will probably be of more service to a community at large and to the people in other parts of the state than will the stub farmers' line.

The contention by George H. Morse (Appendix B, page 284) that illumination of highways will bring rural electrification nearer realization by providing another use for the pole line has much to commend it if coupled with improvement of road surfaces. By reducing headlight glare, illuminating dangerous curves, assisting in making repairs and discouraging hold-ups good highway illumination will increase night traffic and thereby relieve daytime congestion, decrease running time and increase road capacity. In a way similar to that in which improved railroad transportation through small communities has built up activity and prosperity in these communities, improved road surfaces and proper illumination for automobile traffic will improve vehicular transportation for the farmer and indirectly bring increased business and prosperity through increased traffic. Such lighting can help to carry the fixed charges on the electric pole lines along such roads and thereby help reduce the major expense in serving farmers. However, the expense of such lighting may be difficult to justify at present, except on roads which because of their route and surface conditions can be made into main arteries, and then only upon some financing basis which will divide the expense in proportion to the benefits received.

Misleading Comparisons

Some faulty conclusions may result from a study of comparisons of rural-service rates presented by George H. Morse (Appendix B, page 299). Specifically in regard to the Minnesota rates and then with respect to the rates mentioned, it may be said that the first 30 kw.-hr. of use by a farmer is usually for lighting purposes, chiefly between the hours of 5 and 9 in the evening and especially in the winter. With many utility companies the generating and distribution capacity is determined by the load at this time. Therefore any added load will necessitate the installation of larger generating and distribution capacities. On the other hand, if old consumers already using 30 kw.-hr. per month for lighting were induced to use more energy, the demand would probably not come during the critical peak load, and therefore a company could furnish the additional load without increasing generating and distribution capacities. For this reason the sale of the first 30 kw.-hr. to rural customers at a higher rate than the subsequent use can be made to offset the increased fixed charges of serving this peak-load business.

To compare rural rates with others they must be put on a comparable basis. Two things which make electric service for rural districts costlier than electric service for city districts are (1) number of consumers per mile and (2) installed transformer capacity per consumer. Therefore, comparisons are worthless unless these two items are made equivalent. This is emphatically shown in the comparison of the rural district rate for Saltfleet, in Ontario, with rates on the Red Wing project in Minnesota.

The Saltfleet project has seven and four-tenths consumers per mile, while the Red Wing rates are based on three consumers per mile. The figures given in the "Giant Power" report indicate that the Saltfleet project is based on an installed transformer capacity of 1½ kva. per customer, whereas the Red Wing project is based on 3 kva. Furthermore, the Red Wing farmers are using 5-hp. motors, simultaneously with ranges in some cases, served from such transformers, making the actual demand of most of these farms exceed 5 kw. If the fixed charges on the Red Wing line were adjusted for seven and four-tenths consumers per mile instead of three, it would be found that the rates on this line, which was entirely financed by the utility, would fall about 10 to 15 per cent below those for the Saltfleet line, if the latter were receiving the same type of service. This in spite of the fact that the government finances 50 per cent of the cost of construction on the Ontario line. Despite the comments of Mr. Morse (page 302) concerning rates in Wisconsin, it gives the writer a great deal of satisfaction to know that a number of the Wisconsin companies are abandoning the rates mentioned in favor of a type similar to that used on the Red Wing project.

Letters from Our Readers

Record-Breaking Generating Stations in Chicago and New York

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD of May 16 I notice, on page 1039, the statement that the proposed East River generating station in New York City is "laid out for an initial installation of 120,000 kw. and for an ultimate capacity of 700,000 kw., a rating higher than that of any other station now built or designed."

For myself, I believe that we Americans are perhaps too apt to talk about the "biggest" things in the world and that we should do our work with such methods and units as seem to be best adapted to the task in hand without undue emphasis on incidental bigness. Nevertheless, the truth is the truth, and I write to point out that the Crawford Avenue station of the Commonwealth Edison Company of Chicago, which has been in operation more than six months, has an initial rating of 160,000 kw. and is planned for an ultimate rating of 750,000 kw. or more. Of course, no one can foresee the future; the careful words of the company's annual 1924 report were: "Just what this [ultimate] rating will be cannot now be predicted with certainty, but it may well be 750,000 kw. or more."

One of the initial units is of 60,000 kw.; the other two are of 50,000 kw. each. A fourth unit, rated at 77,000 kw., has been ordered, and in a recent speech Samuel Insull said that it appeared altogether likely that the fifth and succeeding units would not be less than 100,000 kw. each in rating. The facts stated indicate that it is incorrect to say that the East River station will have an ultimate rating higher than that of any other station.

WILLIAM E. KEILY.

Chicago, Ill.

Expense Analysis Now in Preparation

To the Editor of the ELECTRICAL WORLD:

In the ELECTRICAL WORLD for June 2, 1923, was published a list of operating economies and production expenses of forty-five generating stations of this country. The figures were the average of a year's operation. I had hoped that a similar table would appear annually and was much disappointed at the non-appearance of one last year. I realize the difficulties involved in obtaining such figures and the possible misinterpretation of them after publication, but in spite of these obstacles, I believe their publication is worth while.

A knowledge of generating costs of different stations scattered over the country, arranged a cording to some convenient classification of sub-accounts for general comparison, should be of help to every generating plant that is interested in reducing costs. It is safe to say that no plant will have the lowest cost in all the sub-accounts, so that even those stations with very low total costs will find some places where they can make improvement. I hope, therefore, that you may find it possible to publish such a table periodically in the future.

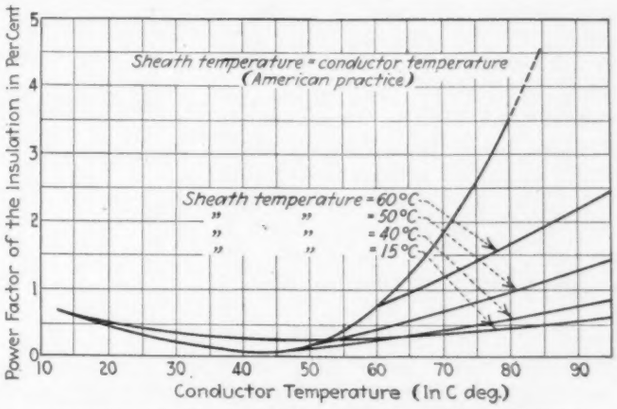
PHILIP C. JONES,
Plant Engineering and Maintenance Department.
Goodyear Tire & Rubber Company,
Akron, Ohio.

Dielectric Losses in Cables

To the Editor of the ELECTRICAL WORLD:

The *Transactions* of the first World Power Conference, which have just come out, contain many articles of interest to American engineers, including two or three papers on high-voltage cables. An article by L. Emanueli of Pirelli & Company on this subject has some points of interest as evidencing an important difference between the European and American points of view and practice—in particular his Fig. 5, which I am reproducing herewith, the curves being copied as closely as possible, the lettering being the writer's.

When the dielectric loss and power factor of cables are measured in this country, the cable users normally require the entire cable to be heated to a given temperature and the measurements to be made under these conditions. It is quite customary in Europe to heat the conductor with current, letting the sheath take its



VARIATION OF CABLE POWER FACTOR WITH TEMPERATURE
From "Electric Cables for Extra High Tension," by L. Emanueli, World's Power Conference

natural temperature or some controlled temperature, the result being that there is a difference of temperature between conductor and sheath. Dielectric losses are measured under these conditions. Although from the standpoint of the testing laboratory it is much easier to meet a given required power factor by the European method of measurement than by the American, and though it is more inconvenient and costly to make tests in such a way, there is from the standpoint of value of the data a good deal to say in favor of this method of measurement, since it, of course, more closely approximates operating conditions than the American method of measurement.

It should be borne in mind, however, that there is a great difference between the two methods of measurement. European readers are less likely than American to be misinformed by articles without such data, since European writers have not uncommonly published dielectric losses on this basis. The greatest likelihood of misunderstanding has been where articles from European publications are copied or translated for publication in America. How great this difference between the two methods of expressing dielectric loss and power factor may be is illustrated clearly in the figure, in which it is shown that a cable with a power factor of 4 per cent under American conditions has an effective power factor of only 1 per cent at the same conductor temperature if the lead sheath is merely cooled to 40 deg. C.

R. W. ATKINSON.

Perth Amboy, N. J.

Central Station and Industrial Practice

Clearances of Crossings Over Railways

By W. C. Wagner and J. B. Straw

THE tabulation of information relating to transmission lines published in ELECTRICAL WORLD Jan. 3, 1925, included the matter of clearances over railways. The provisions of the National Electrical Safety Code, 1920 edition, require minimum clearances of conductors over railways of 27 ft., 28 ft. and 30 ft. for line voltages less than 300 volts to ground, for 300 volts to ground up to 15,000 volts, and for 15,000 to 50,000 volts, respectively, and spans not greater than 150 ft. Increases are provided based upon voltages above 50,000 and spans greater than 150 ft.

A study was made to determine how closely the clearances found to be safe in practice agree with the National Electrical Safety Code provisions. A graph (Fig. 1) was prepared showing the individual overhead clearances tabulated by the ELECTRICAL WORLD expressed in per cent of the corresponding minimum clearances indicated by the code.

The information available was insufficient to permit the inclusion of rule 220(*b*)(3), which requires additional height of supports at a crossing when suspension type insulators are used unrestrained, the addition depending upon the characteristics of the insulator. It should be noted, however, that the points on the graph representing cases subject to this rule would have been lower had the rule been applied —that is, the number of crossings having less clearance than required by the code is actually greater than indicated by this graph.

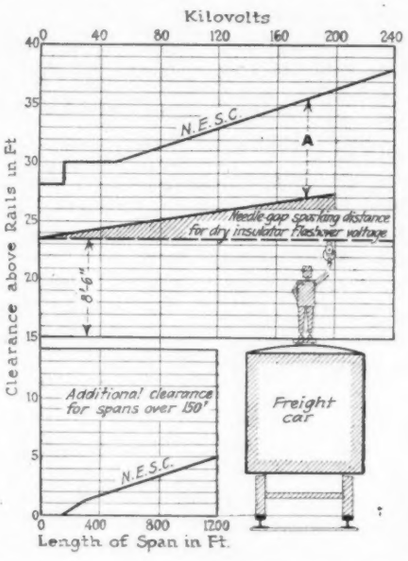


FIG. 2—CLEARANCES OF POWER WIRES ABOVE RAILS

For cases in which the tabulation gives more than one clearance, the smallest was used; if more than one voltage, all are plotted.

The key numbers on the horizontal axis of the graph are the same numbers given for the corresponding items in the tabulation. Item 340 is used to illustrate the method of calculating the per cent difference. This is given in the accompanying table.

In cases in which the clearances are considerably greater than indicated by the code, it is probable that factors other than clearance over rails determined the height of the line, such factors being topography, other lines paralleling the rails, proximity of rails to long-span support, the design of a line for higher voltage than at present used, etc.

Such factors also account for the apparent lack of uniformity in practice. Cases having identical physical and electrical conditions at the crossing would have practically the same clearances. In cases where clearances less than indicated by the code have been shown by experience to be safe, it is probable that local conditions exist which were not considered at the time of the development of the code, or that the number of such cases was small.

In connection with the same study, a chart (Fig. 2) was prepared that shows graphically an application of rule 220(*a*) and 220(*b*) of the code, and at the same time shows the relative position of a brakeman on top of a box car, swinging his lantern. One of the highest box cars and a

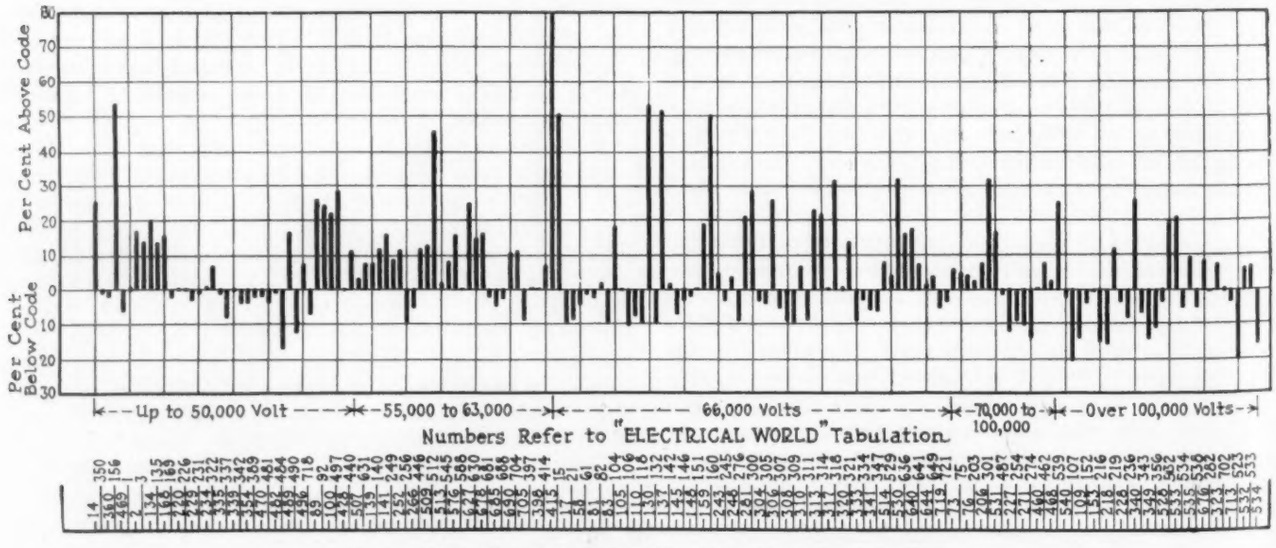


FIG. 1—CLEARANCES OF OVERHEAD CROSSINGS OVER RAILWAYS

Clearances to tracks tabulated by ELECTRICAL WORLD compared with National Electrical Safety Code specified clearances. Differences are expressed in per cent of code values, which include the factors of voltage and span.

COMPARISON OF ACTUAL AND N. E. S. C. CLEARANCES

Actual Clearance (Electrical World Data—Item 340)

Item	340
Voltage	110,000
Normal span, ft.	800
Actual clearance to track, ft.	45

N.E.S.C. Clearance for Crossing Span
Rule 220(*a*) and (*b*)

Clearance for 50,000 volts, 150-ft. span	30 ft.
Increased clearance for (110,000-50,000) volt	30 in.
Increased clearance for span up to 300 ft.	15 in.
Increased clearance for span from 300 to 800 ft.	25 in.
Total clearance	35.8 ft.

Per cent of actual clearances above clearances specified in the N. E. S. C.
(45 — 35.8) ÷ 35.8 = +25.7 per cent.

tall brakeman are represented, the distance from the rail to the bottom of the lantern when at the top of its swing being 23 ft. 6 in.

Above the lantern is a cross-hatched zone that indicates vertically the sparking distance between needle points for the corresponding dry flashover voltages for insulators specified by the code. The distance *A* represents the additional clearance that is required up to 150-ft. spans. The horizontal scale of kilovolts is for the nominal voltage of the line.

In the lower left corner of Fig. 2 is a graph showing the additional increments required by rule 220(*b*) (1) of the code for spans greater than 150 ft. The horizontal scale in feet is for the total length of span. The increments therefore start at the 150-ft. point.

From the foregoing it is evident that safe minimum practice as indicated by the Safety Code provides in many cases clearance values greater than found necessary in practice.

Electric Boiler Used in Hat Industry

By A. S. Goorin

C. B. Goorin Company, Pittsburgh, Pa.

AFTER deciding to install a finishing department in our Pittsburgh building to take care of the blocking of hats, we were faced with the problem of securing a safe, economical source of steam, which is used for softening the bodies of the hats for blocking. The finishing department was installed on the third floor, where a number of empty boxes and cartons are stored. It would have been dangerous to have flames in the proximity of inflammable cardboard boxes, and a brief study showed that the insurance rates would be greatly increased. We therefore turned to electricity as the means to furnish heat for generating steam.

The electric boiler consists of a cylinder tank, 14 in. in diameter by 30 in. high with twenty-four 220-watt Westinghouse space heaters strapped against the sides close to the bottom. A water gage is provided, to show the level of the water in the boiler. There are two steam leads, one for the table where the bodies are blocked, and one for the steam coils which heat the sand bags used for blocking the brims.

This boiler is arranged for automatic control. A pressure gage, operating through a relay and contactor, shuts off the heat when a pressure of 14 lb. is attained in the boiler. A safety relief valve, set to operate at a little higher pressure, is provided as an additional safeguard. There is a lower limit on the pressure gage which turns the electric power on again when the pressure has dropped. The setting of these points may be varied to suit, depending upon the amount of steam used. There is sufficient capacity in the electric boiler to block about ninety-five dozen hats per day.

Although we have never measured the actual amount of current consumed by the electric boiler, an idea of the moderate cost of operating it may be obtained from a comparison of our electric bills before and after the installation of the boiler. This comparison shows that it costs from $6 to $8 per month to operate.

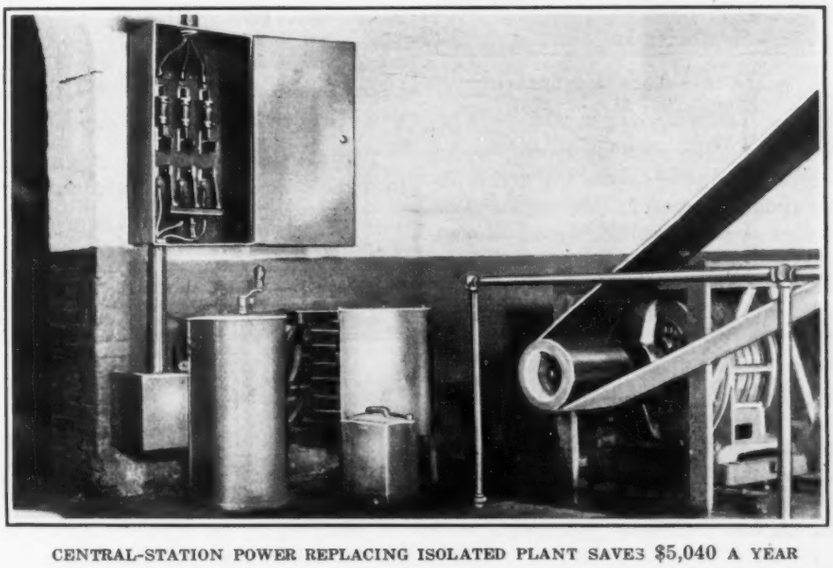
Central-Station Power for Paint Factory

By F. A. Westbrook

Consulting Engineer, New Canaan, Conn.

RECENTLY the paint factory of Baer Brothers at Stamford, Conn., was revamped to a considerable extent by Fred H. Lane, manager of the company. Aside from improvements made in the disposition of the paint-making machinery, a very important change was made in the substitution of electric drive and the use of central-station power in place of an antiquated steam plant.

However, individual electric drive or even group drive was not installed throughout the entire plant, as it would not have been economical to do so at this time. Some new machines have been equipped with individual motors, but the rest of the machines are still run by large motors and heavy belts from the old power room.

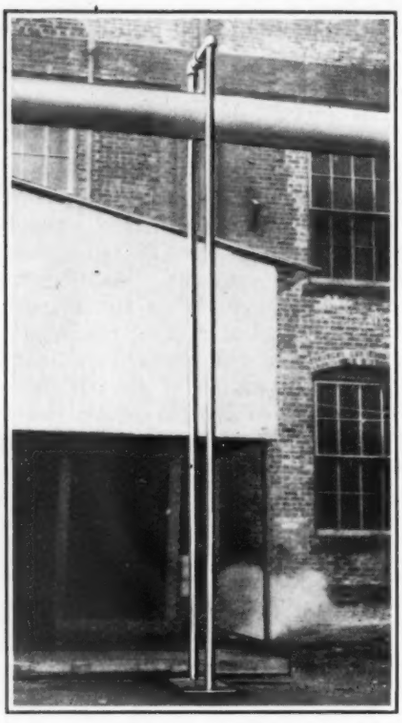


CENTRAL-STATION POWER REPLACING ISOLATED PLANT SAVES $5,040 A YEAR

It is in this old power room that the most striking savings have been made by discontinuing the engines. Power is obtained from the central-station company at 2,300 volts, three-phase, sixty-cycle, and is stepped down to 230 volts by a bank of three transformers located in a small inclosure in the yard and adjacent to the power room.

There are two 150-hp. boilers,

which formerly supplied one 125-hp. Ames engine and one 125-hp. Corliss engine. These required five tons of coal a day and the services of a fireman at $30 a week. In place of the engines there has been installed



SMALL TRANSFORMER SUBSTATION ADEQUATELY SAFEGUARDED

a 150-hp. synchronous motor, which keeps the power factor up, and a 75-hp. induction motor. The synchronous motor is a rewound Sprague generator that had been discarded from one of the company's other plants. The induction motor was also one that was formerly in use but had been taken out of service while still in good condition. The company also had power transformers at another plant that were not being used and consequently they were installed here. Thus the engines, one of which was soon to be discarded, were replaced for the cost of rewinding an old generator and the installation and wiring charges, which were as follows:

Rewiring generator	$178.00
Two new drive pulleys	161.40
Installation and wiring of both motors	5,000.00
Switchboard and compensator	762.00
Power company's charges for bringing in service	400.00
Lighting transformer and wiring	95.00
Engineering and incidental expenses	1,000.00
Total	$7,596.40

The motors were located so that no new shafting or belts were required and only two new pulleys had to be installed at an expense that was practically negligible.

The saving is the cost of five tons of coal a day when heat is not required and four tons a day (approximately) on the average during the six cold months; also the wages of a fireman at $30 a week for the entire year, because the engineer now has so little to do that he can attend to keeping up the heat. All items entering into the problem follow:

5 tons of coal per day for 6 months at $4.80	$3,600
4 tons of coal per day for 6 months at 4.80	2,880
Wages of fireman $30 per week for a year	1,560
Savings per year	$8,040
Cost of current from central station	3,000
Saving per year	5,040

The Corliss engine, which is still in usable condition, is retained for break-down service, but so far there has been no call for it.

Eventually a more complete electrification will be desirable with a view to eliminating heavy and expensive belting and power losses, but the changes indicated are a great improvement and a preliminary step in the right direction. The transformer capacity and main switchboard have been designed so that they will fit in with future additional motorization at the proper time.

Method of Choosing Wires and Cables

FOR power-house and substation construction the Utica Gas & Electric Company follows the accompanying tables in choosing the size of wires and cables. Table I gives the rating of wires and cables, under three conditions, X, Y and Z. Condition X is for high-voltage, large conductor construction with good ventilation, condition Y represents medium conditions, and condition Z is for low-voltage construction with free ventilation. Detailed classifications under these three conditions for single-conductor cable are given in Table II.

This information was compiled by the General Electric Company and has now been adopted as standard practice by the Utica Gas & Electric Company.

TABLE II—CLASSIFICATION OF CONDITIONS X, Y AND Z SINGLE-CONDUCTOR CABLE

Maximum Ampere Capacity	In Free Air: Varnished Cambric or Paper Up to 750 Volts	In Free Air: Varnished Cambric or Paper Up to 3,500 Volts	In Free Air: Varnished Cambric or Paper Up to 15,000 Volts	In Free Air: Rubber Up to 750 Volts	In Ducts: Varnished Cambric or Paper Up to 750 Volts	In Ducts: Varnished Cambric or Paper Up to 3,500 Volts	In Ducts: Varnished Cambric or Paper Up to 15,000 Volts	In Ducts: Rubber Up to 750 Volts
175	Z	Z	Y	Y	Z	Y	Y	Y
360	Z	Y	Y	Y	Y	Y	Y	Y
675	Z	Y	Y	Y	Y	Y	Y	X
1,075	Z	Y	Y	Y	X	X	X	X

Twin or Triple Conductors

Maximum Ampere Capacity	In Free Air: Varnished Cambric or Paper Up to 15,000 Volts	In Free Air: Rubber Up to 750 Volts	In Ducts: Varnished Cambric or Paper Up to 15,000 Volts	In Ducts: Rubber Up to 750 Volts
175	Y	X	Y	X
550	Y	X	X	X

TABLE I—WIRE AND CABLE RATING FOR POWER-HOUSE AND SUBSTATION CONSTRUCTION

Table of current-carrying capacities of cables based on conditions X, Y and Z (see Table II).

Maximum Permissible Capacity, Amp.	Size of Terminal (Diameter of Cable Hole), In.	Condition X	Condition Y	Condition Z
8	0.137	19/25	19/25	19/25
15	0.137	19/22	19/25	19/25
25	0.20	No. 8	19/22	19/22
35	0.20	No. 6	No. 8	No. 8
50	0.25	No. 4	No. 6	No. 6
70	0.3125	No. 2	No. 4	No. 6
110	0.419	No. 1/0	No. 2	No. 4
130	0.461	No. 2 0	No. 1 0	No. 2
175	0.586	No. 4 0	No. 2 0	No. 1/0
225	0.669	Circ. Mil. 300,000	No. 4 0	No. 2/0
290	0.776	400,000	Circ. Mil. 300,000	No. 4/0
360	0.881	500,000	400,000	Circ. Mil. 300,000
450	0.944	600,000	500,000	400,000
550	1.084	750,000	600,000	500,000
675	1.209	1,000,000	750,000	600,000
775	1.461	1,250,000	1,000,000	750,000
900	1.699	1,500,000	1,250,000	1,000,000
1,075	2.012	2,000,000	1,500,000	1,250,000
		CABLES IN MULTIPLE		
1,300	2—1.699	2—1,250,000	1—2,000,000	1—1,500,000
1,500	2—2.012	2—1,500,000	2—1,250,000	1—2,000,000
1,750	2—1.699	2—1,500,000	2—1,250,000	2—1,250,000
2,100	2—2.012	2—2,000,000	2—1,500,000	2—1,250,000
2,600	4—2.012	4—1,250,000	2—2,000,000	2—1,500,000
3,100	4—2.012	4—1,500,000	4—1,250,000	2—2,000,000
4,200	4—2.012	4—2,000,000	4—1,500,000	4—1,250,000
5,200	6—2.012	6—1,500,000	4—2,000,000	4—1,500,000
6,200	6—2.012	6—2,000,000	6—1,500,000	4—2,000,000

Modified N. E. L. A. Cable Joints

Procedure Followed by Kansas City Company in Making Three-Conductor, 15,000-Volt Cable Joints Based on Experience with Previous Construction

BY D. D. CLARKE
Electrical Engineer Kansas City Power & Light Company

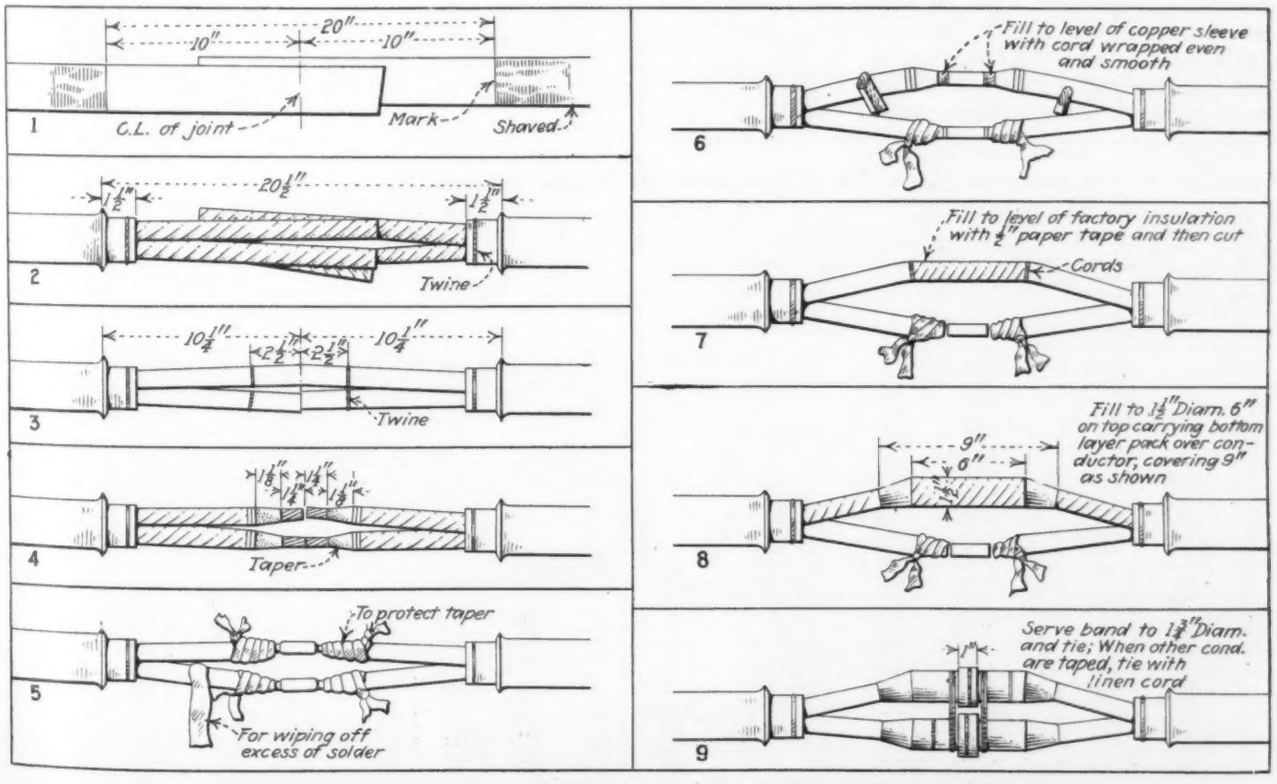
AS A RESULT of considerable experience with underground cables and analyses of joint failures, the Kansas City Power & Light Company has adopted the N. E. L. A. specifications for 15,000-volt cables, modified somewhat to adapt the joints to conditions which have been experienced. The procedure and specifications adopted apply to No. 3/0 three-conductor cables, with $\frac{7}{32}$-in. saturated paper on each conductor and $\frac{7}{32}$-in. saturated-paper belt insulation. The joint is of the type known as the bunched joint, in which all three conductors are cut to the same length, no attempt being made to stagger the respective conductor splices.

After the cables have been trained around the manhole and laid in their final positions with the ends overlapping, the first step in starting the joint is to establish a center line at the position desired as the center of the finished joint. At a distance of 10 in. each way from the center line the lead sheaths are marked, creased and shaved for wiping. After stearine has been applied over the shaved surface the lead sheath on each cable is removed back to the creases previously mentioned, thus exposing the cable ends for a span of 20 in.

After the edges of the sheaths have been belled out about $\frac{1}{4}$ in. with a fiber wedge, the outer belt insulation is removed from the cable ends, beginning at a distnace of $1\frac{1}{2}$ in. from the edge of the lead sheath, where it is tied with linen twine. Next the six conductors are matched in pairs as determined by phasing tests. If matching of phasing cannot easily be made with slight distortion or twisting of leads, it is not considered advisable to do the phasing at the joint. Having matched the corresponding conductors, the ends should be cut so as to give a snug butt joint.

Each conductor in turn is then given the following treatment: Twine is fastened tightly around the paper insulation by a double half hitch about $2\frac{1}{2}$ in. back from the end of each conductor to prevent unwrapping during the subsequent operations. The insulation is then cut through to the copper with insulation cutters $1\frac{1}{4}$ in. from the end and tapered carefully with a sharp, thin knife, starting $1\frac{1}{8}$ in. back from the cut. In performing this operation great care is exercised to avoid leaving ridges and to maintain a uniform angle of slope. It has been found necessary to keep a sharp razor edge on the trimming knife, and the edge must be sufficiently wedge-shaped to avoid nicking the copper. For sharpening this tool the company recommends a small fine red India oil stone. The surface of each taper is next covered temporarily with a strip of clean dry linen tape wound tightly about it and tied in place to protect the paper from scorching or other damage during the succeeding operations.

The lead sleeve should now be slipped over one of the cables and pushed back past the hanger out of the way. The ends of the conductors are then cleaned with gasoline and tinned copper sleeves fitted in place. These sleeves are about 2 in. long and $\frac{5}{8}$ in. wide and must be of the variety with tapered ends so as to avoid all sharp corners. Furthermore, they must fit snugly without having to expand the sleeves. With the copper sleeve fitted in position and the tapered surfaces of insulation protected with cloth, the sleeves are sweated in place, a small quantity of stearine being used for the flux. The solder is wiped carefully

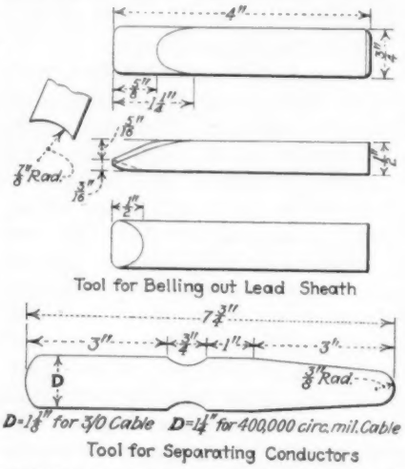


STEPS IN PROCESS OF MAKING 15,000-VOLT NO. 3/0 THREE-CONDUCTOR CABLE JOINT

by means of linen tape or twine to remove any excess lumps or sharp edges and also thoroughly to fill up the depression in the slot. Care is taken that absolutely no sharp edges or drops of solder are left at the bottom of the sleeve and that the conductors shall meet in the center of the sleeve.

Taping the conductors is the next step. The linen tape wrapping over the tapered insulation may now be removed from one of the conductors, but should be retained on the others until the taping of those is to be started. The depression in each end of the copper sleeve is filled up flush with impregnated twine from a tape carton, extreme care being taken to lay the twine smoothly and without ridges or depressions and to finish with a half hitch so as to leave the filling flush with the copper sleeve. Over the string and copper sleeve is applied a sufficient amount of compound from the tape carton to make absolutely sure that all possible voids or air pockets are eliminated. Before performing this operation the carton is warmed by the helper to a point just below fluidity of the compound to assure a safe working temperature. Each carton contains sufficient tape for one joint.

Rolls of ½-in. width are used until the splice has been built up to the same diameter as the factory conductor insulation, after which impregnating compound from the tape carton is applied. Each layer of paper is pulled taut and tightened by hand, preferably with the aid of a small piece of clean cloth so as to make a firm joint and force the excess compound out to the edges of the tape. The tape is wound without lapping, but with the edges as closely together as possible. Compound is applied after each layer of tape has been completed to eliminate all voids or air pockets. Rolls of 1-in. width are used to build up the contour of the splice back of the factory insulation, covering a total length of 10 in. at the conductor insulation and 6 in. on the outside, where the total diameter will be 1½ in. During this taping the compound is applied between layers as explained before. Before extending the tape over the cable adjacent to the splice, the tie strings that were used about the insulation close to the taper to prevent the paper from unwinding during the work of splicing are cut off.



TOOL FOR BELLING OUT LEAD SHEATH AND TOOL FOR SEPARATING CONDUCTORS

After each conductor has been taped as explained, all three are served together with a band of 1-in. tape built up around each conductor in the center of the splice to a diameter of 1¾ in. When all three conductors have thus been finished, they are bunched together and tied with linen twine. No outer belt of insulation tape is used.

Next the lead sleeve is slipped over the joint and the ends are beaten down over the bells of the sheaths and wiped. Two compound filling holes are cut in the sleeve about 2 in. from each end, of sufficient size to admit the tip of the spout of a teakettle. One end of the splicing is raised slightly (about ⅜ in.), and "Ozite" compound at a temperature of 350 deg. F. is poured into the lower hole until it issues freely and without bubbles from the upper opening. This may require some time and a considerable amount of compound. However, the excess may be caught in a pan held below and used again, if great care be taken to avoid pollution by moisture and dust. After the bubbling stops (it being assumed that by this time all air and dampness have been expelled from the sleeve), the joint is allowed to cool for one and one-half hours, when a second filling is made to fill the voids due to shrinkage of the first filling. After another half hour, when the second filling has solidified, additional compound is poured in to fill the joint completely. The two openings in the lead sleeves are then closed and the cuts are sealed with a soldering iron.

Capacity Necessary to Raise Power Factor

The table given herewith is available through the courtesy of J. L. Merrill, consulting engineer, Philadelphia, Pa. The table gives kva. and ampere values of 1 kw., 220 volts, 60 cycles, two-phase or three-phase with correction necessary to raise 1 kw. to 100 per cent, 90 per cent and 80 per cent power factor. The last five columns of this table, derived from the first part of the table, have been found very effective and useful, particularly the first of these five columns that shows the necessary correction for each five points from 15 per cent power factor to 100 per cent. It will be noted from this that the maximum effect of 1 kva. in correction is produced between 75 per cent and 85 per cent power factor and that the correction necessary to raise your power factor from 95 to 100 per cent is practically the same as that required between 37 and 42 per cent.

Power Factor	Kva.	Two-Phase Amp.	Three-Phase Amp.	Kva. to Raise 1 Kw. to 100 per Cent	Two-Phase Decrease in Amp.	Three-Phase Decrease in Amp.	Kva. to Raise 1 Kw. to 90 per Cent	Two-Phase Decrease in Amp.	Three-Phase Decrease in Amp.	Kva. to Raise 1 Kw. to 80 per Cent	Two-Phase Decrease in Amp.	Three-Phase Decrease in Amp.	Difference in Power Factor from 100 per Cent	Difference in Amp. Two-Phase	Difference in Amp. Three-Phase	Two-Phase Ratio Amp. to Kva.	Three-Phase Ratio Amp. to Kva.
100	1.000	2.272	2.624	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
95	1.052	2.390	2.760	0.328	0.118	0.136	.....	.....	.....	.....	.....	.....	0.328	0.118	0.136	0.35	0.41
90	1.111	2.525	2.915	0.484	0.253	0.291	.....	.....	.....	.....	.....	.....	0.156	0.135	0.155	0.86	0.99
85	1.176	2.672	3.086	0.617	0.400	0.462	0.133	0.147	0.171	.....	.....	.....	0.133	0.147	0.171	1.10	1.28
80	1.250	2.840	3.280	0.749	0.568	0.656	0.265	0.315	0.365	.....	.....	.....	0.132	0.168	0.194	1.27	1.46
75	1.333	3.029	3.498	0.881	0.757	0.874	0.397	0.504	0.583	0.132	0.189	0.218	0.132	0.189	0.218	1.43	1.65
70	1.428	3.245	3.747	1.020	0.973	1.123	0.536	0.720	0.832	0.271	0.405	0.467	0.139	0.216	0.249	1.55	1.79
65	1.538	3.495	4.036	1.169	1.223	1.412	0.685	0.970	1.121	0.420	0.655	0.756	0.149	0.250	0.289	1.67	1.93
60	1.666	3.786	4.372	1.332	1.514	1.748	0.848	1.261	1.457	0.583	0.946	1.092	0.163	0.291	0.336	1.78	2.06
55	1.818	4.131	4.770	1.518	1.859	2.146	1.034	1.606	1.855	0.769	1.291	1.490	0.186	0.345	0.398	1.85	2.13
50	2.000	4.545	5.248	1.732	2.273	2.624	1.248	2.020	2.333	0.983	1.705	1.968	0.214	0.414	0.478	1.93	2.23
45	2.222	5.050	5.831	1.984	2.778	3.207	1.500	2.525	2.916	1.235	2.210	2.551	0.252	0.505	0.583	2.00	2.31
40	2.500	5.681	6.560	2.291	3.409	3.936	1.807	3.156	3.645	1.542	2.841	3.280	0.307	0.631	0.729	2.05	2.37
35	2.857	6.493	7.497	2.676	4.221	4.873	2.192	3.968	4.582	1.927	3.653	4.217	0.385	0.812	0.937	2.10	2.43
30	3.333	7.575	8.746	3.179	5.303	6.122	2.695	5.050	5.831	2.430	4.735	5.466	0.503	1.082	1.249	2.15	2.48
25	4.000	9.090	10.497	3.873	6.818	7.873	3.389	6.565	7.582	3.124	6.250	7.217	0.694	1.515	1.751	2.18	2.52
20	5.000	11.363	13.121	4.899	9.091	10.497	4.415	8.838	10.206	4.150	8.523	9.841	1.026	2.273	2.624	2.21	2.55
15	6.666	15.150	17.493	6.587	12.878	14.869	6.103	12.625	14.578	5.838	12.310	14.213	1.688	3.787	4.372	2.24	2.59

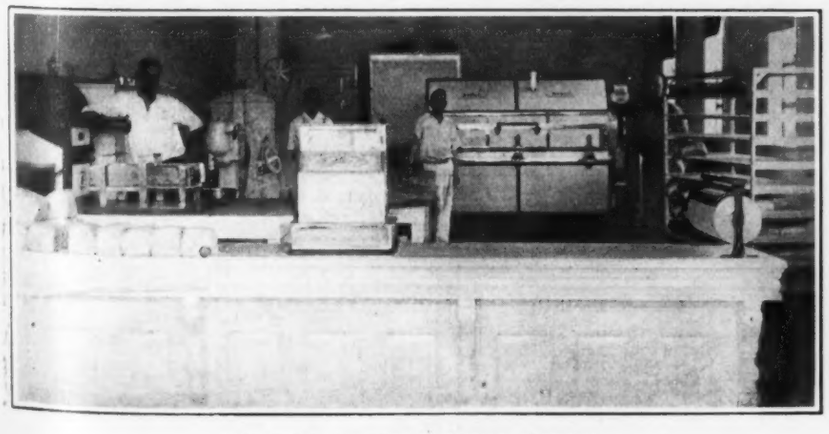
Commercial Activities and Public Relations

Electric Oven Substitutes for Apprenticeship

CERTAINTY of operation in producing the same standard quality of product in an electric bake oven recently saved a bakery in Gladwin, Mich., considerable inconvenience and possible loss of trade, when the head baker quit and could not be replaced at once. The owner of the shop had recently installed a new electric oven, advertised it well, and the quality of his pastry, rolls and so forth was bringing in new customers every day. Without a baker it seemed he could not continue and threatened loss of trade at the busiest season would have been serious. In desperation, he called on the company that had installed the oven and asked for a baker.

The oven demonstration man was sent and on his arrival found two boys working in the shop, the proprietor's son, who had been taking care of sales and delivery, and another young man, who had been the baker's helper for a short time. Neither of them had ever done baking. He immediately took them in hand, and, while supplying perfectly baked goods for sale, he taught them the art of baking. The accuracy of temperature control and the even, thorough heat penetration characteristic of the electrically heated oven made this task unusually easy. After only two weeks the demonstrator was able to leave behind a smoothly running bakery operated by the proprietor's son, who in this short time had become a first-class bread baker, and the former helper, who was now a pastry baker.

The characteristics of the electric bread baking oven that made these results possible are found in other forms of electric heating apparatus also. The accuracy of temperature control and the even heating obtained when electric heat is used often makes it possible to employ unskilled labor where highly skilled men were formerly required. Thus the skilled men are made available for other, more profitable work, costs are cut down, and better results are obtained.



INTERIOR OF THE ELECTRIC BAKERY

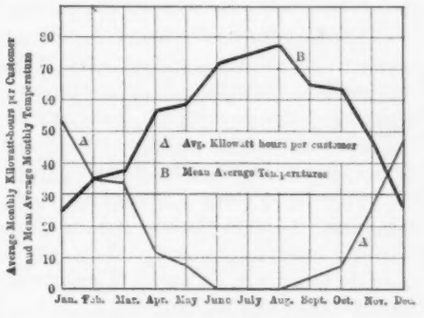
Residential Fuel Oil Burners Make Desirable Load

Actual Consumption, Demand and Revenue from Twenty-one Installations Show Oil House Heating Equipment to Be Good Revenue Producer

BY B. J. GEORGE
Industrial Engineer Kansas City Power & Light Company, Kansas City, Mo.

USE of motor-driven oil burners in the furnaces of residential heating systems has increased rapidly within the last few years and the installation of this equipment makes a very desirable addition to the residential customer's connected load. From a revenue-earning standpoint this device ranks well up with such appliances as fans, percolators, toasters, flatirons and so forth, and as it is estimated that there are now 175,000 automatic domestic oil burners installed in homes in the United States and the number is increasing, the importance of this business to central-station companies is readily apparent.

The value of this business and its load characteristics were recently made the subject of a careful study by the Kansas City Power & Light Company. Late in December, 1923, the company, desiring to obtain information concerning the cost of electricity for electric refrigerating machines, secured permission from the occupants of a number of residences to set sub-meters on their refrigerator motor circuits. At the same time it was decided that data relative to motor-driven oil burners would be interesting if not valuable. Accordingly sub-meters were set on about twenty-five oil burner installations and approximately a year's operation has been observed. The burners include a variety of makes.



USE OF MOTOR-DRIVEN OIL BURNERS IN RESIDENCES

Variation of average kilowatt-hours used per month per customer with mean average monthly temperatures. Data taken from nine typical installations.

The sub-meters were read monthly at the same time as the house meter. The cost of electricity for the oil burners was then determined by subtracting the kilowatt-hours registered by the sub-meter from those registered by the house meter, and then recomputing the bill for energy. The difference between the bill as actually rendered and the recom-

puted bill was taken as the cost of the energy consumed by the burner, although some may contend with much logic that the true cost is the average cost per kilowatt-hour for the month multiplied by the number of kilowatt-hours shown on the submeter. However, the particular method of computing the cost need not be argued here.

Since the records do not cover exactly 365 days, the results were prorated to 365 days. Table I gives the summary of the data for twenty-one of the installations. The cost of operation given is the observed cost prorated to 365 days. The rates in effect are as follows:

	Cents per Kw.-Hr.
First 5 kw.-hr. per room per month	7.5
Next 5 kw.-hr. per room per month	5.0
All over 10 kw.-hr. per room per month	2.5
Minimum bill, 50 cents.	

The number of rooms is determined by excluding alcove, attic (unfurnished), bathrooms, cellar, closets, coal shed, den, garret (unfurnished), garage, hallways, laundry, pantries, piazza, porches, portico and toilets.

Table II shows the energy consumption by months for nine installations covering periods of approximately one year. Table III gives the mean temperature for Kansas City for the year 1924 as given by the United States Department of Agriculture. Note how closely the variations in the consumption coincide with the average temperature.

It is interesting to note that the twenty-one installations of Table I show an average connected load of ⅛ hp. (200 watts at 75 per cent efficiency), a total average yearly consumption of 194 kw.-hr. per customer, an average annual cost of $5.25 per customer and an average net rate of 2.71 cents per kw.-hr.

TABLE I—ANNUAL ELECTRICAL CONSUMPTION OF MOTOR-DRIVEN OIL BURNERS IN RESIDENCES AS SHOWN BY SUB-METERS INSTALLED ON MOTOR CIRCUITS

Customer	Size Motor (Hp.)	No. Active Rooms	Period of Observation (Days)	Kw.-Hr. for Period	Prorated to Kw.-Hr.	365 Days Cost
1	1/4	10	354	328	338	$8.45
2	1/4	14	354	190	196	4.85
3	1/4	8	361	246	249	6.27
4	1/4	12	367	280	278	6.96
5	1/8	7	357	136	139	3.58
6	1/10	8	336	178	193	4.84
7	1/10	12	362	224	226	5.65
8	1/10	12	362	260	262	6.55
9	1/10	10	367	244	243	5.97
10	1/10	9	359	250	254	6.35
11	1/10	9	276	67	89	2.91
12	1/10	8	367	170	169	4.23
13	1/10	17	371	254	250	6.35
14	1/10	8	367	210	209	5.27
15	1/10	11	370	152	150	3.75
16	1/20	5	336	104	113	4.43
17	1/20	6	353	112	116	3.67
18	1/20	4	367	100	100	4.76
19	1/20	7	366	88	88	4.88
20	1/20	9	364	152	153	4.11
21	1/20	8	333	236	259	6.47
Total	2.43	194	7,449	3,981	4,074	$110.30
Average	0.12	9	355	190	194	5.25

TABLE II—TOTAL AND AVERAGE KW.-HR. CONSUMPTION OF OIL BURNER MOTORS USED BY NINE RESIDENCE CUSTOMERS

Customer No.	3	4	7	8	9	12	13	14	15	Totals Monthly	Average
Rooms (active)	8	12	12	12	10	7	17	8	11		
January	64	60	42	52	58	42	62	56	48	484	53.8
February	36	48	32	44	30	30	42	34	22	318	35.3
March	36	38	42	50	18	24	40	38	22	308	34.2
April	8	12	14	16	20	14	10	2	8	104	11.6
May	8	10	10	6	8	2	8	6	8	66	7.3
June	0	0	0	0	0	0	0	0	0	0	0
July	0	0	0	0	0	0	0	0	0	0	0
August	0	0	0	0	0	0	0	0	0	0	0
September	2	4	6	2	8	0	4	2	2	30	3.3
October	8	12	12	6	10	0	6	6	4	64	7.1
November	38	32	34	26	32	12	26	26	12	238	26.4
December	46	64	32	58	60	46	56	40	26	428	47.6
Totals	246	280	224	260	244	170	254	210	152	2,040	226.7
Yearly average	20.5	23.3	18.7	21.7	20.3	14.2	21.2	17.5	12.7	17.0	18.9

This represents an annual revenue of $26.25 per kilowatt of demand, assuming 100 per cent demand factor. The figure of $5.25 per year represents the actual increase in the billing due to the addition of the burner motor. For the nine customers of Table II, a total annual consumption of 227 kw.-hr. per customer is shown.

The importance of the motor-driven oil burner as a revenue producer is shown by a comparison with the figures usually given for domestic appliances. Taking the demand and consumption figures given by Robert Montgomery and assuming a net rate of 4 cents per kilowatt-hour, Table IV was prepared showing the annual revenue for various appliances. A figure of 200 kw.-hr. per year was used for the oil burner, based upon these observations. The writer has used an average net rate of 4 cents as being a fair figure for the average cost per kilowatt-hour for such appliances as a whole, requiring no one appliance to carry the burden of the less favorable rate.

Comparing the figures, the motor-driven oil burner produces an annual revenue of $8 per customer and an annual revenue of $40 per kilowatt of demand, ranking next to the electric refrigerating unit and above the electric fan and range as a revenue producer per unit of demand. This leads this company to believe that

TABLE III—MEAN MONTHLY TEMPERATURES IN KANSAS CITY, MO. (1924), AS GIVEN BY THE UNITED STATES DEPARTMENT OF AGRICULTURE

	Maximum	Minimum	Average
January	34	16	25
February	43	26	35
March	45	30	38
April	67	47	57
May	68	49	59
June	81	63	72
July	83	66	75
August	87	69	78
September	74	56	65
October	74	54	64
November	56	37	47
December	34	18	26
Average for year	62	44	53

TABLE IV—ANNUAL REVENUE PER KILOWATT OF DEMAND FOR MOTOR-DRIVEN OIL BURNERS IN RESIDENCES COMPARED WITH OTHER APPLIANCES (BASED ON A NET RATE OF 4 CENTS PER KW.-HR.)

Appliance	Maximum Demand in Watts	Annual Kw.-Hr. Consumption	Equiv. Hours Use of Demand	Annual Revenue	Annual Revenue per Kw. of Demand
Washer	300	20	66	$0.80	$2.67
Grill	500	34	68	1.36	2.72
Toaster	500	37.5	75	1.50	3.00
Iron	575	67	116	2.68	4.66
Percolator	400	48	105	1.92	4.80
Cleaner	170	25	147	1.00	5.89
Radiator	600	96	160	3.84	6.40
Range	5,000	1,500	300	60.00	12.00
Fan	40	31	775	1.24	31.00
Oil burner	200	200	1,000	8.00	40.00
Refrigerator	300	864	2,880	34.56	115.20

Note: Data in first three columns (other than for oil burners) taken from paper published by Robert Montgomery.

central-station managers can well investigate the desirability of oil burners as a part of the residence load.

Kitchen Lighting Units Now Specified in New Houses

AN INTERESTING result of the steady exploitation of kitchen lighting units at Worcester, Mass., during the past year or two is their specification by builders of dwellings as a part of the standard equipment of the home. Scarcely a house being put up this year in Worcester, whether for speculation or for immediate occupancy, is without such a unit. One leading electrical contractor has installed more than 400 units within the past year, and it is roughly estimated that between four and five thousand units are now in service in the city.

The Worcester Electric Light Company recommends 100-watt installations, and this rating is prevalent. In house-wiring jobs the company is providing for a limited time a chain-drop kitchen lighting unit at the price usually charged for a drop light, viz., from $2.50 to $3. All wiring is done by contractors.

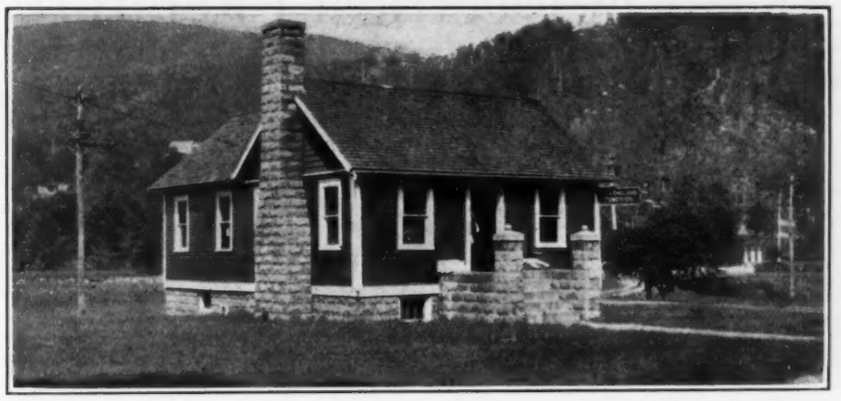
Accounting a Militant Science

"ACCOUNTING is essentially a militant science; to live it must war unceasingly against carelessness, ignorance, inefficiency and possibly against dishonesty," declared George W. Hurn, manager Haverhill (Mass.) Electric Company, at a recent meeting of the New England division N.E.L.A., in Boston, in contravention of the oft-accepted idea that the work of the accountant is merely one of routine and passive interest. "The public utility account," said Mr. Hurn, "is a judge to whom appeals must be made by the management for three essential things: First, classifying and tabulating the effect of business operations and verifying the accuracy of these tabulations; second, interpreting these effects so as to show the financial condition of the business, the profitableness of its operations, the efficiency and economy with which these operations have been carried on, and the fidelity of the employees, and also to establish budgetary and financial control; third, devising and installing mechanism and routine necessary for accomplishing these purposes.

"By scientific investigation and establishment of ideal efficiency standards and the detailed comparison of actual with standard unit costs, it is practicable to ascertain the exact location of operating inefficiencies and to measure them; then the causes of such inefficiencies can be investigated and eliminated. It is necessary to have a plan on which future efforts will be based. If plans are to be successfully carried out they must be based on the records of the past. In order that the management may keep within the limits of planned appropriations it must have records of progress.

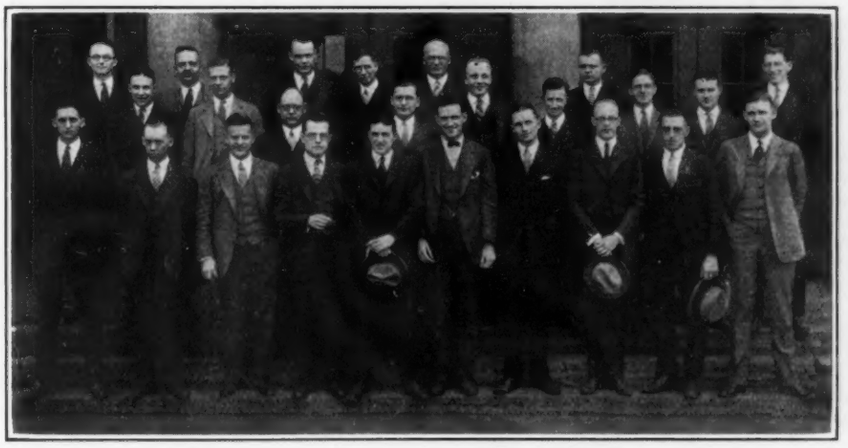
"To my mind the accountant is of value to the management according to his ability to perform these functions successfully, which can be summarized in the three things: the mechanical operation of keeping books, the provision of rules for these operations and checking them, and the interpretation of the results shown by the records. Without these no business can be successfully managed."

Making Divisional Offices Fit Surroundings



THE bungalow type of building has been effectively utilized by the New England Power Company in its western division headquarters office at Shelbourne Falls, Mass., illustrated above. This pleasing structure shows how easily an electric company can contribute to the architectural attractions of its "home towns" by exercising forethought in design and by "good housekeeping" methods after the building is in service.

Power Salesmen Attend School in Industrial Heating



THE fourth annual course in industrial electric heating for central-station power sales engineers was concluded by the General Electric Company recently, when thirty representatives of various central stations throughout the United States attended the two weeks' school held at the Schenectady and Pittsfield plants of that company. The course ran from May 11 to May 23 and included a series of lectures by General Electric engineers and a number of inspection trips, both in that company's plants and in plants of industrial users of electric heating equipment.

The object of this course is to acquaint the central stations with the possibilities of this type of load, its applications and advantages. These annual courses are given under the auspices of the power committee of the National Electric Light Association in co-operation with the manufacturers of industrial electric heating apparatus.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

First Chinese High-Voltage Plant.—K. MOSIG.—Located near the railroad line from Shanghai to Nanking, a steam power plant has recently been finished which, it is claimed, feeds the first Chinese high-voltage transmission system. The power house contains two 4,000-kva. steam turbo-generators, operating at 3,000 r.p.m. and delivering 6,600 volts to two 2,000-kva. and one 4,000-kva., three-phase transformer, raising the voltage to the transmission potential of 33,000. The main consuming center is 18 miles away. There are in all five substations connected to the system, stepping the voltage down to 2,300 and 380/220. The transmission line is supported on reinforced-concrete towers built in China. It is expected to enlarge this station in the near future with two additional units of 10,000 kva. each, for which room has been provided in the plant.—*Siemens Zeitschrift*, April, 1925.

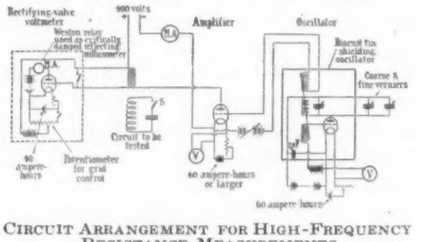
Test of a Prosser-Type Reciprocating Steam Engine.—L. V. LUDY.—The distinctive feature of the engine under consideration is the steam jacketing. Not only the cylinder walls but the heads, piston, piston rod and valve case are steam-jacketed. Test data, performance charts and indicator cards are given. Efficiency ratios varied from 0.626 with saturated steam at about 133 lb. and 21-in. vacuum to 0.774 with 100 deg. superheat and 27-in. vacuum. The paper is followed by a discussion which includes a comparison with other types of engines.—*Mechanical Engineering*, April, 1925.

Analysis of Fuel Gas.—S. W. PARR and F. E. VANDAVEER.—A comprehensive review of the methods employed in gas analysis combined also with investigational work as to the efficiency of these methods has been made. These details have been included in an appendix. There is also given a synopsis of the methods which are less adapted to the type of apparatus developed as a result of the studies made in connection with this work. These methods are listed in the method of procedure necessary for carrying out the analysis. A discussion of alternate methods or methods to be used with other forms of apparatus is also given fully in an appendix.—*Circular No. 12, Engineering Experimental Station, University of Illinois.*

Units, Measurements and Instruments

Photographic Study of High-Voltage Discharges.—K. O. OPLINGER, K. B. MCEACHRON and R. H. GEORGE.—The material presented in this 118-page bulletin represents the results of several methods of attack used to determine the mechanism and characteristics of the corona discharge. The subjects covered are the use of revolving electrodes and revolving mirror camera, early investigation of corona in nitrogen and oxygen, investigation of corona in these two gases with improved apparatus, velocity of electric wind from needle electrodes, current and voltage relations in point-plane discharge, current-voltage characteristics of direct-current corona, direct-current spark potential and corona current, and the corona spectrum. The results of all of the tests have been summarized and discussed as a whole before drawing general conclusions which take into consideration all of the information obtained.—*Bulletin No. 19, Engineering Experiment Station, Purdue University.*

A High-Frequency Resistance Measurement.—E. MALLETT and A. D. BLUMLEIN.—The method depends on the change in the apparent impedance of a coil that occurs when an oscillatory circuit is coupled to it magnetically. It thus permits measurements to be made on the oscillatory circuit without introducing any instruments into it. As shown in the accompanying diagram, which represents one of the circuit arrangements, a small oscillating tube supplies an emf. to an amplifying valve with a negative bias on the grid so that circuit changes taking place beyond the amplifier do not affect the oscillator. The coil impedance is measured with the milliammeter and the rectifying valve voltmeter. For the procedure by which the resistance is found and for illustrative examples the original article should be consulted.—*Journal of I. E. E. (England)*, April, 1925.



CIRCUIT ARRANGEMENT FOR HIGH-FREQUENCY RESISTANCE MEASUREMENTS

Generation, Control, Switching and Protection

Load Characteristic of a Dynamo Giving Constant Current Over a Large Range of Speed.—J. C. PRESCOTT.—A graphical method of predicting the characteristics of a constant-current dynamo, such as the Rosenberg or Brolt, has been developed, and, in the appendix, the formula derived by the late Dr. Gisbert Kapp has been extended to determine the maximum current flowing in the short-circuited paths of the armature and the steady value of the load current. It is also shown that the maximum value of the short-circuit current occurs when the load current reaches half of its final value. Tests on a non-salient-pole machine are cited to show that the constant-current characteristic of the Rosenberg dynamo may be attained without the use of slotted or salient poles.—*Journal of I. E. E. (England)*, February, 1925.

Effects of Gases in Transformer Oils.—C. J. RODMAN and A. H. MAUDE.—The selection of the kind of oil is paramount if a study of the chemical behavior is considered. The outstanding classification of oils may be divided into three groups, namely, (1) paraffinoid, (2) naphthenic, (3) asphaltic. With recent advances in refinery technology any of the groups may now be used as insulation oil crudes. The life or durability of an oil depends upon its history, method of refinement and subsequent conditions of use, in which gases play an important part. By the judicious weighing of these factors no difficulty in practice of use of insulating oils will be encountered. Under abnormal operation of the transformer combustible gases are liberated as a result of hot-spot or electrical discharge, and these when mixed with atmospheric air cause a possible serious explosion hazard. This condition is completely obviated by maintaining a continuous blanket of inert gas over the oil, which also gives the additional desirable protection of a compressible gas cushion that relieves the tank of excess pressure in case of electrical failure of the transformer. A study of the effect of gas on the life of insulating oils is given, showing that oxidation through the agency of oxygen causes most troubles in insulating oil practice, while reducing or inert gases have a continued preservative effect. Methods for determining the solubility of gases in oils and of analyzing the composition of the gases dissolved in oils are given.—*Presented before the American Electrochemical Society, Niagara Falls*, April 23-25, 1925.

Transmission, Substations and Distribution

Current Rating of Single-Conductor, Lead-Covered, Low-Tension Cables on Single-Phase Alternating-Current Circuits.—S. W. MELSOM and W. E. BEER.—The first part of this paper presents the results of numerous tests to determine the loading for a given temperature rise in air. The effect of spacing in an iron-free neighborhood, of the interposition of iron, and of the cable cross-section is investigated. The ratio between alternating-current loading and direct-current loading is given for the several conditions. The problem of the flux, emfs. and current in the lead sheath is then taken up theoretically and the mathematical analysis worked out in detail.—*Journal of I. E. E. (England)*, February, 1925.

Acid-Proof Cables.—O. BODEMANN.—Great difficulties are experienced with light and power lines in permanently humid rooms, such as chemical establishments, dye works, dairies, laundries and stables. Steel-armored cables will rust very soon, cables in steel pipes will accumulate water, lead-covered cable installations are very expensive if properly made, and bare wires on porcelain rolls are not always safe. A new type of cable was therefore developed, particularly suited for just these cases, called Anthygron cable. Its conductors are insulated with seamless rubber pressed together to avoid air spaces. Surrounding them is a seamless metal tube, which itself is covered with four layers

of special acid-alkali-resisting fibrous coatings. Directly in contact with the metal tube a bare third conductor may be employed, serving either as the neutral or as a grounding wire. The cable is manufactured for a maximum of 250 volts to ground. A complete line of accessories, such as junction boxes, switches, pendent or wall lights and wall entrances, has been designed specially for this new cable.—*Siemens Zeitschrift*, April, 1925.

Illumination

Electric Lighting Equipment on Automobiles.—J. H. HUNT.—A summary of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. spring convention, April 25, 1925, on page 862.—*Journal of A. I. E. E.*, May, 1925.

Lighting the Home.—This bulletin shows how an average home of modern design should be wired and lighted so as to obtain wholly satisfactory illumination and complete enjoyment of the electrical features. Each room is treated separately with a floor-plan diagram showing the location of the lighting and convenience outlets as well as the control switches. Suggestions are given as to the most suitable sort of lighting fixtures. — *Bulletin E-105, Westinghouse Lamp Company.*

Motors and Control

Single-Phase Repulsion Motor. — G. WINDRED.—The principle of operation, theory of commutation and characteristic performance curves are reviewed in this article.—*Electrician* (*England*), May 1, 1925.

Applications of Motors to Mine Locomotives.—W. A. CLARK.—This paper discusses the rule-of-thumb method of applying motors to mine locomotives. It shows why the speed of the locomotive should be considered and indicates a rational method of selecting motors for locomotives for general application, taking account of track, grade and acceleration resistance and of the reduced load that occurs during periods of gathering service.—*Journal of A. I. E. E.*, April, 1925.

Pulling Into Step of Synchronous Induction Motors.—H. COTTON.—When studying the phenomenon of the pulling into step of a synchronous induction motor from the mathematical point of view it is usually assumed that the synchronizing torque is a sinusoidal function of the angular distance between the stator and rotor fields. The present study points out that the assumption is erroneous for several reasons, the most important of which is the effect of armature reaction. This sets up a double-frequency component in the synchronizing torque which very considerably modifies the conditions during synchronizing. The synchronizing torque of a salient-pole motor also possesses a double-frequency component, but it is produced differently from that of the non-salient-pole motor. It is shown that the operation of the motor when this component is taken into account is amenable to mathematical solution. An experimental investigation carried out on a small induction motor run as a synchronous motor is also described. The bibliography appears to be exhaustive. It covers a large number of references in various languages. — *Journal of I. E. E.* (*England*), February, 1925.

Electrophysics, Electrochemistry and Batteries

Dielectrics and Electrons.—F. FERNIE. — The author discusses in non-mathematical form some problems in relation to the presence of electrons in a charged dielectric, among them absorption-current effects, nature of dielectric breakdown, time-lag failure and unequal voltage gradient.—*Electrician* (*England*), April 24, 1925.

Electrolytic Refining of Aluminum.—FRANCIS C. FRARY. — After outlining the history of methods used heretofore for the electrolytic production or refining of aluminum and pointing out the underlying principles, the author describes the new Hoopes cell, whereby metal of an average purity of more than 99.80 per cent can be commercially produced in any desired amount. This cell is divided horizontally into two electrically insulated sections, the joint between them being water-cooled. The lower half contains the carbon bottom lining in which rests the molten anode alloy. Upon this is superimposed the molten bath layer, and on this floats the molten aluminum cathode. The bath is a mixture of cryolite, aluminum fluoride and barium fluoride nearly saturated with alumina. Electrical connection to the molten cathode is made by means of graphite electrodes dipping into the floating aluminum layer. The anode is a copper-aluminum alloy low in iron and titanium. The operation is continuous, the necessary amount of molten impure aluminum, with enough impoverished anode material to make an alloy heavier than the molten bath, being poured into the anode layer through a carbon funnel. This raises the level of the entire molten mass, and the pure cathode metal is allowed to flow off at the top. The cells are stated to operate with an excellent current efficiency on about 20,000 amp. at from 5 to 7 volts. The working temperature lies between 900 deg. and 1,100 deg. C.—*Chemical and Metallurgical Engineering*, May, 1925.

Traction

Ramsay Condensing Turbo-Electric Locomotive.—GEORGE F. JONES and T. LAURENCE HALE.—This paper contains a somewhat brief but very specific description of the Ramsay locomotive, illustrated with views showing various features of the design, which of necessity differs greatly from that of the usual forms either of recriprocating steam or full electric, and drawings giving the arrangement of parts and the principal dimensions. The outstanding elements are the nine-stage impulse turbine, taking steam at 200 lb. superheated to 685 deg. F. and exhausting into a 27-in. vacuum, flexibly coupled to an 890-kw., 600-volt, three-phase alternator, these being on the front portion of the locomotive, and the evaporatively cooled condenser on the rear portion. The two parts are connected by a universal joint, and each carries two driving motors. By operating the turbine at half speed and connecting the motors in cascade a starting torque equal to three times the normal running torque is obtained up to quarter speed. The next steps are to connect the motors in parallel and finally to bring the impulse turbine to full speed.—*Mechanical Engineering*, April, 1925.

Automatic and Semi-Automatic Mercury-Vapor Rectifier Substations.—G. ROGERS.—This is a descriptive paper, fifteen pages in length, discussing briefly the principal features of the mercury-vapor rectifier as now obtainable, both of the glass and of the steel-shell type. The paper shows how this device is applied in substations designed to supply direct current in regions remote from existing sources of supply, where, on account of the limited load, conversion by means of rotating apparatus would not be economically feasible. Circuit diagrams, load charts and costs are given for a number of such stations. The presentation of the paper called forth considerable discussion, which is also reported. — *Journal of I. E. E.* (*England*), February, 1925.

Telegraphy, Telephony, Radio and Signals

Telephone Transmission Standards.—DR. F. BREISIG.—Abstracts of earlier papers discussing the relative merits of the *TU* and the βl system have been given in the Digest. The present paper is a reply to Colonel Purves' advocacy of the *TU* system in the *Electrician* of January 30 and February 6. The writer's contention is that the physical meaning of the results measured with the apparatus of either system is the same, but that in the one system the interpretation is directly in the same figures which would result if a calculation instead of a measurement had been made, and that it is independent of terminal conditions, while the other system (the *TU*) involves a ratio not independent of terminal conditions. He gives illustrative values.—*Electrician* (*England*), April 17, 1925.

Communication in Railroad Operation.—I. C. FORSHEE.—This paper is summarized in the ELECTRICAL WORLD report of the spring convention of the A. I. E. E., April 25, 1925, on page 862.—*Journal of A. I. E. E.*, May, 1925.

Line Radio and the Effects of Metallic Conductors on Underground Communication.—J. J. JAKOSKY and D. H. ZELLERS. — The authors deal with a study of line radio or wired-wireless methods of communication wherein electrical energy is transmitted by metallic conductors. The report contains a discussion of the chief factors affecting carrier-current transmission, with particular reference to application to underground communication for mines; a description of typical underground circuits used for power and lighting, and a description of apparatus used and results obtained in line-radio experiments in coal mines, including circuit diagrams and conclusions as to power requirements and limitations for mine use.—*Serial No. 2682 of the Bureau of Mines.*

New Books

Telephone Communication

By Charles Allen Wright and Albert Frederick Puchstein. New York: McGraw-Hill Book Company, Inc. 515 pages, illustrated: Price, $5.

The introduction to this work includes brief mention of many points of historical interest. The early chapters are largely of a descriptive nature and are profusely illustrated by photographs of central-office equipment, outside-plant construction and substation and cord-circuit diagrams. There is, however, a question as to the value of some of the illustrations, for example, Figs. 12 to 27 inclusive, 44, 46, 78, 80, 103 and 105.

In the chapter on transmission and its measurement and in the last third of the book, which is devoted largely to maintenance and testing of telephone apparatus and circuits and cross-talk measurements, emphasis is placed on the practice of the art, and these sections should appeal particularly to the telephone electrician. The student will find much of interest and value in the eighty pages devoted to the transmitter, receiver and transformations, where sufficient detail is given to indicate some of the problems involved, and in the fifty pages on the more highly technical subject matter pertaining to wave propagation and electric wave filters.

With the exception of machine switching, practically every phase of telephone communication is included; in fact, so much ground has been covered that many topics have been passed over with brief mention. However, the numerous references to other works will be of considerable assistance to those who desire to go more deeply into the subject. The authors have brought together valuable material from scattered sources, including a discussion of vacuum tubes and their application to wire and radio communication.

H. M. T.

Superheat Engineering Data

A handbook on the generation and use of superheated steam. Sixth edition, revised (superseding Data Book for Engineers). New York and Chicago: The Superheater Company. 208 pages, 85 illustrations and diagrams, 69 tables. Price, $1.

This handbook contains condensed data for steam power-plant engineers and operators. A feature of the book is the index, consisting of sixteen pages and making reference easy. Superheated steam, its advantages over saturated steam and the proper design and performance of superheaters are briefly discussed. It illustrates superheater arrangements in practically all stationary, marine and locomotive type boilers commonly made in America. Waste-heat, portable and separately fired superheaters are also treated of. Brief comparative data are given as to sizes, tube sizes, arrangement of tubes, etc., for the stationary water-tube boilers illustrated. The steam tables cover pressures from below atmospheric to 600 lb., absolute, and include properties of superheated steam from 50 deg. to 300 deg. F. superheat.

The section on piping includes information for figuring piping for handling water, saturated and superheated steam and velocity and pressure drop of water and steam flowing through piping. In this section are included also the proposed American standards for high pressures. The book also contains engineering data on coal-fired and oil-fired boilers, which include tables on heat values for gaseous, liquid and solid fuels. Other miscellaneous data include complete conversion tables and data on bolts and screw threads, with the recent work of the American Engineering Standards Committee and the National Screw Thread Commission. There are in addition many miscellaneous tables frequently used by steam engineers.

Mechanical Design of Overhead Electrical Transmission Lines

By E. G. Painton. New York: D. Van Nostrand Company. 274 pages, illustrated.

A very thorough and complete textbook on the mechanical side of transmission-line design and erection. The author has not hesitated to go to the fundamental, mathematical and technical principles underlying the mechanical design of transmission-line structures and conductors and has then added the practical considerations which modify the principles of theoretical design. A discussion of conductors of all types, with their limits and details and test data, is given, followed by a splendid treatment of sag and stress problems based on the correct solution of the catenary and introducing most of the best short-cut methods for solving these problems.

Transmission-line supports are treated in good fashion, including sample detailed computations of tower design which should prove very valuable to those interested in this aspect of the subject. The computations for supports under different conditions are explained, and the different types of supports used, with their limitations and advantages, are treated in some detail. The problem of insulators is treated in a basic manner, starting with ceramics and including tests, methods of erection and a discussion of the common types of insulators, both pin and suspension. An excellent chapter on wooden-pole supports deals with all modern types of structures, together with computations showing how to determine the strength of structures under different conditions. In addition to this the author has treated of the construction detail equipment used in transmission work, showing size, methods of mounting, methods of construction and other things that construction men are interested in. In conclusion a chapter is devoted to erection methods for field forces building transmission lines.

The viewpoint of the author is international in that he has culled practices from all over the world, and the book should be of great help to all those interested in the mechanical aspects of transmission-line design.

Application of Hyperbolic Functions to Electrical Engineering Problems

By A. E. Kennelly. Third edition. 346 pages, illustrated. New York: McGraw-Hill Book Company, Inc.

Largely through the instrumentality of Dr. Kennelly, hyperbolic functions have become very popular in the active solution of electrical engineering problems, particularly when they are applied to long-distance high-tension transmission lines. The revision of this fundamental text, which outlines the whole theory of the hyperbolic function and its application to transmission, has occurred in good time. The major changes are the replacing of old material with that which is more recent and the addition of five new appendices. In these appendices Dr. Kennelly treats admirably the establishment of the equivalent T and Π of a network of alternating-current conductors with respect to any two pairs of terminals in the network. The new edition is free from errors found in the older editions, has been brought up to date and should prove extremely useful to transmission engineers. In some ways the addition of a table of hyperbolic functions would greatly facilitate the use of the book by those who are not in a position to procure hyperbolic-function tables readily.

Book Notes

Fahrleitungsanlagen für Elektrische Bahnen. By Fr. W. Jacobs. 290 pages, 400 illustrations. Munich and Berlin: R. Oldenbourg.

This book covers in a strictly practical way the planning and the actual layout of trolley systems and suburban railways, with some information on secondary main-road electrification. An unusually large number of well-selected illustrations and the exclusive use of concrete values for all calculations make it excellently suited for the practical engineer in the field.

Patents, Invention and Method. By H. E. Potts. 160 pages. London: Open Court Company.

An entirely readable book on patents and inventions, with particular application to the chemical industry. Chapters are given on the application of mathematics to law, predictions and inventions in chemistry, language and style in the patent law, definitions, scientific methods and patent practice, and the influence of the patent law on the evolution of research.

Books Received

An Outline of Automatic Telephony. By William Aitken. London: Ernest Benn, Ltd. 143 pages, illustrated. Price, 5s. net.

Fundamental Principles of Generators and Motors; Examples. By Prof. F. E. Austin. Hanover, N. H.: Published by the author. 108 pages, illustrated. Price, $2.50.

Electricity Meter Practice. By H. G. Solomon. Philadelphia: J. B. Lippincott Company. 189 pages, illustrated.

Bau Grosser Elektrizitätswerke. Second enlarged and improved edition. Berlin: Julius Springer. 608 pages, illustrated.

Laboratory Manual of Electrical Science. By Ralph Buck and H. E. Frost. New York: The Bruce Publishing Company. 160 pages, illustrated. Paper. Price, $1.44.

Der Quecksilberdampf-Gleichrichter. By Kurt Emil Müller. Berlin: Julius Springer. 217 pages, illustrated.

Concerning the Nature of Things. By Sir William Bragg. New York: Harper & Brothers. 250 pages, illustrated.

Electrical Machinery Erection. By Terrell Croft. New York: McGraw-Hill Book Company, Inc. 314 pages, illustrated. Price, $3.

The Metallurgy of Aluminum and Aluminum Alloys. By Robert J. Anderson. New York: Henry Carey Baird & Company, Inc. 913 pages, illustrated. Price, $10.

News of the Industry

"Orange" and "Blue" Specials Leave for San Francisco

Sixty or more delegates and visitors from Eastern points left Chicago on the "Orange Special" on Monday of this week for the San Francisco convention of the National Electric Light Association via the Chicago, Milwaukee & St. Paul Railway, the Union Pacific and Southern Pacific lines. They arrived at Spokane on Wednesday, where they were the guests of the Washington Water Power Company, and reached Snoqualmie Falls on Thursday, where they joined the seventy-six travelers on the "Green Special" en route to Seattle, Portland and San Francisco. The "Orange Special" was in charge of B. J. Mullaney, vice-president People's Gas Light & Coke Company, Chicago.

From New York the "Blue Special," affording the last chance for Atlantic Coast delegates to reach the Pacific in time for the opening of the convention, left on Wednesday afternoon in charge of Ralph Neumuller of the United Electric Light & Power Company, New York. It carried sixty-eight delegates, who were joined at Chicago by forty more.

The advance guard of attendants at the 1925 convention has already reached San Francisco, and all is ready for Monday.

Hetch Hetchy Power and Pacific Gas & Electric

Despite the failure of the citizens' advisory committee in San Francisco and officials of the Pacific Gas & Electric Company to reach an agreement regarding the temporary disposal of the power to be generated at the city's Hetch Hetchy plant (see ELECTRICAL WORLD for May 30, page 1142), it seems likely that this energy will be distributed through the lines of the Pacific Gas & Electric Company until such time as the people decide by their ballots whether or not the city shall go into the power business.

This, at any rate, was the announcement made by Mayor Rolph following an executive session of the members of the special committee of Supervisors having the matter in charge. The assistant city attorney was called into the meeting and instructed to draw up a contract with the Pacific Gas & Electric Company to conform to the terms of the Raker act, under which the Hetch Hetchy reservoir was built, and protect the city's interests. The contract was to be taken at once to Washington and submitted to the Secretary of the Interior for approval.

Mayor Rolph stated that the special committee was determined to make a quick and thorough job of the Hetch Hetchy power proposition and get it settled, so that the revenue could be used for the benefit of the taxpayers. The Mayor announced that the special power committee which he heads, after hours in conference with Wigginton E. Creed, president of the Pacific Gas & Electric Company, had "unanimously agreed that the city's power be distributed under a contract which will conform to the provisions of the Raker act."

Alabama Power Orders Three 45,000-Hp. Units

Contracts have been closed by the Alabama Power Company for three 45,000-hp. (maximum) hydraulic turbines for its Cherokee Bluffs development, on the Tallapoosa River. These units will operate on 150-ft. head, that being the height of the dam nearing completion. Two of them have been ordered from the Allis-Chalmers Manufacturing Company and one from William Cramp & Sons. The contracts call for delivery within eight months.

The Cherokee Bluffs dam, as previously reported in the ELECTRICAL WORLD, is the first of six to be built by the Alabama Power Company on the Tallapoosa River. The six dams and power houses will, it is estimated, eventually cost the company $39,000,000, and another $80,000,000 will be necessary for substations and transmission lines. It was originally intended to make the initial installation 90,000 hp. By ordering a third unit this, as stated, has been raised to 135,000 hp. The impounded area at the Cherokee Bluffs development will be 39,200 acres and contain sixty billion cubic feet of storage water, ranking among the large artificial lakes of the world.

New Los Angeles Steam Plant Put on Line

Completing the first unit of its Seal Beach steam plant one month ahead of schedule, the Los Angeles Gas & Electric Corporation on June 1 added 35,000 kw. to its generating capacity. The ultimate capacity of this station, which was described in the ELECTRICAL WORLD for May 30, page 1123, is to be 200,000 kw., which will be larger than that of any previous steam plant on the Pacific Coast. It will be possible to use either natural gas or oil as fuel. Current is generated at 13,200 volts, stepped up to 110,000 volts and transmitted to Los Angeles, a distance of 30 miles.

The Los Angeles Gas & Electric Corporation expects to spend approximately $8,000,000 on additions to its generating, transmission and distribution systems during the rest of the year. One-half of this sum is to be expended on the new Seal Beach station together with necessary substations and transmission lines to handle the additional power generated. The balance is to go toward general extensions of the distribution system, including the purchase of 24,800 meters.

Stone & Webster Take Over Gould Properties

Confirmation of the sale of a controlling interest in the Virginia Railway & Power Company by Frank J. Gould to a purchasing syndicate of which Stone & Webster form the most important interest carried with it this week the information that the Spottsylvania Power Company, serving Fredericksburg and owning valuable power sites on the Rappahannock River in Virginia, was included in the property changing hands. Unauthorized estimates are that a cash consideration of at least $11,000,000 was involved in the deal for control of the Virginia Railway & Power Company. The properties will be under the executive management of Stone & Webster, and, according to Mr. Stone, "the policy of the new owners will be to render first-class service, to co-operate fully with the customers, the general public and the authorities, and to provide extensions to the plants and other facilities as rapidly as necessary to keep pace with the growth of the territory served."

Conowingo Delay Persists

Location of a state bridge at the site of the proposed fifty-two-million-dollar power project on the Susquehanna River, near Conowingo, Md., has, it is said, necessitated still further delay in the approval of the project by the Pennsylvania and Maryland Public Service and the Federal Power commissions. O. C. Merrill, secretary of the Federal Power Commission, has announced that at a conference in Harrisburg with the Pennsylvania Public Service Commission he was informed that the Philadelphia Electric Company had not completed a revision of construction plans. It does not seem likely that material progress will be made before July at least.

Detroit Edison Plans Spending Nearly Ten Millions

Petitions have been filed with the Michigan Public Utilities Commission by the Detroit Edison Company for authority to issue an additional $8,000,000 worth of construction bonds. The money which the bond issue provides is to be used in the expansion program planned for the Detroit and southeastern districts. This issue, it is planned, will provide about one-half of the new capital estimated to be needed for the calendar year and the first months of 1926. A summary of the construction budget shows that the company will spend an additional sum of $9,790,000 on new construction work before October 1 of this year, provided that the new bond issue is approved.

The proceeds of this issue will be applied toward the construction of three new substations in the downtown

district of Detroit, a new steam-heating plant in the same district, very large extensions of the underground cable transmission system, an additional tower line with two circuits at 120,000 volts between the Trenton Channel plant and the western industrial district of Detroit, a new hydro-electric plant at French Landing on the Huron River, which will go into commission late in the summer, and numerous expenditures toward the provision of distribution wires, line transformers, service connections and meters for an expected addition during the calendar year of more than 36,000 customers.

Muscle Shoals Commission Against Lease

Would Make No Disposition of Power Before Congress Meets, but Points to Fact that War Department Can Exercise Such Powers as It Has Without Commission's Sanction

NO RECOMMENDATION will be made by the President's Muscle Shoals Commission for the disposal of the power which will become available at Muscle Shoals during the testing period. The commission, however, at a meeting held in Washington June 10, went emphatically on record as being opposed to any lease of power or properties prior to final action by Congress. The commission went further and expressed the belief that no one should be allowed to erect any structures on the site and that no outside agency should be permitted to participate in the operation of the plant.

These expressions are put forward in a letter to the Acting Secretary of War in reply to the communication which he addressed to the commission on April 14. In that letter Secretary Davis asked for the views of the commission on two plans which he outlined. One plan was for the sale of power under a contract which would be revocable at any time by the War Department. The other provided for a revocable lease for the steam plant and the hydro-electric power with a provision that a portion of the power be made available for use at Nitrate Plant No. 2, which might be leased to a third party. To these suggestions the commission replies as follows: "After a long and careful study it is the opinion of the members of the Muscle Shoals inquiry that until Congress has taken action no lease, temporary or otherwise, of the plants, power or their properties should be made. We do not believe that any person, persons or corporations should be permitted to erect on the site any buildings or other structures or in any way participate in the operation of the plant prior to final action by Congress. We further believe that the testing out and the tuning up of all of the hydro-electric machinery and other power equipment should be carried out under the direction and the responsibility of the Chief of Engineers of the United States Army.

"As far as the disposition of any power which may result from the testing and tuning up of this plant previous to the settlement of the matter by Congress is concerned, this inquiry does not believe that it can add in any way to whatever authority or jurisdiction the War Department may now have. We, therefore, leave this phase of the matter entirely in the hands of the War Department, reiterating our opposition to leasing or participation of others in the project."

While the letter was signed only by Chairman McKenzie, it had the approval of all members of the commission. In some respects the letter evidently was intended to round out the record, as the commission knew that developments since the Secretary's letter was written have precluded leasing of the power. The War Department expects to test out the machinery under load and will arrange informally for compensation for such power as is fed into the interconnected system of the Southern power companies. So the commission's letter has no bearing on the immediate situation. As the testing period will extend from August until June of next year, ample opportunity will be given for Congress to act.

The discussion of the Secretary's letter and the drafting of the reply took up most of the time at the commission's second meeting, but some further allocation of work was made among its members. The work before the commission lends itself better to this type of handling. No further meeting probably will be called for a month at least. The individual members, in addition to their studies of the various phases of the problem, are being kept busy going over the mass of material which has been submitted in response to the commission's call for suggestions bearing on the disposition of the Muscle Shoals properties.

Commission's Decision on Niagara Merger Deferred

The New York Public Service Commission reserved decision on Wednesday on the application of the Buffalo, Niagara & Eastern Power Corporation, the holding corporation organized to take over the capital stock of the Niagara Falls Power Company, Buffalo General Electric Company, Niagara, Lockport & Ontario Power Company and Tonawanda Power Company under the recent merger agreement. Decision may be given within two weeks.

Central Maine to Buy Bethel Company

An agreement has been reached between the Bethel (Me.) Light & Power Company and the Central Maine Power Company under which the former will be acquired by the latter on Ju'y 1. The Bethel company's stock will be retired. Construction of an 11,000-volt line, 15½ miles long, from West Paris to Bethel to connect the two systems is now under way. The line will supply lighting and power service as required in the towns of Locke's Mills and Wa'ker's Mills and will also pass through Bryant's Pond.

Insull Interests in East

Central Maine Power Company Likely to Go to Middle West Utilities—Manchester Sale Rumored

FURTHER extension of the Insull interests into New England is forecast by an agreement reached last week providing for the purchase of a controlling interest in the Central Maine Power Company by the Middle West Utilities Company of Chicago. To a representative of the ELECTRICAL WORLD President Walter S. Wyman of the Central Maine company stated that the agreement provides that if 65 per cent of the common stock of the company is deposited as a sanction, the Middle West company will acquire the control in case the valuation engineers of the Insull organization report favorably upon the property after investigating it. At this writing the price offered for the stock has not been officially stated, but it is reported to be in the vicinity of $140 per share.

CENTRAL MAINE'S STATUS

The Central Maine is one of the best known and largest systems in New England. It was begun in 1905 as the Messalonskee Electric Company and now represents a consolidation of about sixty electric, gas and electric railway properties, serving a total of 193 communities and generating about 150,000,000 kw.-hr. per year. The company operates twenty-two hydro-electric and two steam plants, and its gross earnings in 1924 were slightly more than $3,000,000.

There are at present outstanding $10,622,000 in bonds, $600,000 in notes, $2,500,000 in common stock, $8,978,500 in 7 per cent preferred stock and $660,000 in 6 per cent preferred stock. It serves the Kennebec and Androscoggin valleys and principal cities and towns lying in general between the territories of the Bangor Railway & Electric Company and of the Cumberland County Power & Light Company of Portland, and through interconnection and customer ownership has accomplished remarkable progress in the two decades which span its growth. Nearly half the population of Maine is served by the system, which operates over 600 miles of transmission lines, mainly 33 kv. Recent hydro-electric developments of the company include a large station at Skowhegan, on the Kennebec River, and a comprehensive redevelopment of the plants on the Messalonskee. Various water-power rights are owned which will permit comprehensive plant construction in the future.

The Middle West company recently acquired a controlling interest in the Vermont Hydro-Electric Corporation, at Rutland, Vt., and if the Central Maine negotiations are consummated, this organization, already operating the Twin State Gas & Electric Company properties at Berlin and Dover, N. H., St. Johnsbury and Bennington, Vt., will become one of the most prominent factors in New England utility affairs.

It is rumored, moreover, that the Insull interests are actively negotiating for the Manchester (N. H.) Traction, Light & Power Company, which would, if acquired, no doubt be added to the Middle West Utilities holdings.

Connecticut Legislature Acts on Savings-Bank Investments

The Connecticut Legislature has just passed a bill making legal for savings-bank investment first and refunding mortgage bonds of twelve of the strongest public utility companies in the country. The Connecticut bill is virtually the same as a recent Massachusetts bill vetoed by the Governor of that commonwealth. The utility issues made legal include first mortgage bonds of Brooklyn Edison, Cleveland Electric Illuminating, Duquesne Light, Kansas City Power & Light, New York Edison, New York & Queens Light & Power, Niagara Falls Power, Pennsylvania Water & Power, Philadelphia Electric, Southern Power, Union Electric Light & Power and some of their subsidiary companies. Additions to the list are to be made from time to time as they meet the approval of the state banking commission. It is expected the Massachusetts Legislature will next fall again act on a bill placing a liberal construction on investment in utility issues.

Electrical Credit Men Meet at Philadelphia

Convening first at Atlantic City on Saturday, June 6, the National Electrical Credit Association continued its sessions in Philadelphia on Monday and Tuesday last. In addition to hearing the reports and addresses of the business sessions, the two hundred members present attended a banquet at the Bellevue-Stratford, where Frederic P. Vose, national secretary, acted as toastmaster. Albert H. Elliott, secretary of the Los Angeles association, spoke on the Constitution of the United States. In place of Dr. Milton H. Nichols, who was to have spoken, Dr. E. J. Cattell of Philadelphia gave an address. A musical comedy preceded dancing.

New officers were elected as follows: President, H. G. Wilkins, Belden Manufacturing Company, Chicago; vice-president, F. T. Bell, Westinghouse Electric & Manufacturing Company, Philadelphia; secretary-treasurer (re-elected), Frederic P. Vose, Chicago.

Osgood Addresses Utah Engineering Council

Farley Osgood, president of the American Institute of Electrical Engineers, was the principal speaker at the annual banquet of the Engineering Council of Utah, held at the Hotel Utah in Salt Lake City recently, at which about two hundred guests were present. In his address Mr. Osgood entered into a general discussion of the engineering profession, outlining its accomplishments for the welfare of humanity, and urged all engineers to a greater participation in activities of a public nature. He declared that modern engineering education is one-sided and in many cases wholly inadequate and advocated the formation of a committee to acquaint the Society for the Promotion of Engineering Education with the real problems which face the engineer after he has left college.

George M. Bacon, State Engineer of Utah and president of the Engineering Council of Utah, also spoke. Markham Cheever, chief engineer of the Utah Power & Light Company, was toastmaster.

Feather River Power Company Buys Property

Preparatory to starting construction on its large hydro-electric development on the Feather River, the Feather River Power Company has purchased 2,500 acres of land in Plumas County, Cal., for which $250,000 is said to have been paid. A dam is to be built on Bucks Creek which will store 110,000 acre-feet of water. The first of six plants to be built will develop 50,000 hp. under a head of 2,400 ft. (ELECTRICAL WORLD, April 18, page 833) and will cost approximately $8,500,000.

Work on the dam will begin with little delay, it is announced. Officials of the company met June 3 with directors of the Honcut-Yuba Irrigation district, with whom a tentative contract for supplying water has been made.

Manufacturers Take Up Topics of the Day

A. M. E. S. Finds Encouragement in Supreme Court Decision on Trade Association Activities—Progress in Electrical Code Work and Standardization Reported

THE progress of code development, standardization and the changing attitude of the government toward trade association activities formed the principal topics at the annual convention of the Associated Manufacturers of Electrical Supplies, which was in session from Monday until Friday of this week at Hot Springs, Va. As usual, the program consisted primarily of separate meetings of the various sectional groups devoted to the interests of specific or related products. There were also two general meetings, presided over by Vice-president H. W. Bliven, President William H. Thornley being abroad.

The present status of national and international standardization was reviewed by C. E. Skinner, chairman of the American Engineering Standards Committee, in an address embracing the work of the committee, the Bureau of Standards and the Department of Commerce and defining their functions in this field. Because of the very general lack of understanding on this point, many matters are at present being taken to the government that should be brought to the A. E. S. C. for action, and in the hope of clarifying the situation the committee is arranging for a publicity service to industry.

In discussing the recent decision of the United States Supreme Court in regard to trade associations, F. E. Neagle, counsel for the A. M. E. S., interpreted the changed official attitude in Washington toward the co-operative activities of industry. This action by the Supreme Court, he said, for the first time frankly concedes that courts cannot impede the economic laws which have operated since the world began, and the announced intention of the Federal Trade Commission to publish hereafter a statement of the defense at the time of formal accusation puts the government in the position of providing helpful protection rather than in an attitude of interference and obstruction.

The new set-up of the electrical committee of the National Fire Protection Association, with the status of a section of the American Engineering Standards Committee, was reviewed at length by H. R. Sargent, with detailed recommendations for further code revision.

The "red seal" advisory committee (E. W. Kendall chairman) indorsed the work of the Society for Electrical Development in the organization of the "red seal" plan in various cities, reporting that licenses have now been granted to the electrical leagues of Syracuse, Rochester, Buffalo, Pittsburgh, Louisville, Detroit. Poughkeepsie and Atlanta and are in process in some eighteen other cities in addition to those Pacific Coast communities which will operate the "red seal" through the California co-operative bureau. The committee recommended that the manufacturers subscribe to a bond of $25,000 needed to finance the establishment of the "red seal" plan throughout the country.

NICHOLSON ON THE TARIFF

Electrical manufacturers were urged by S. L. Nicholson to raise their voices in opposition to any tariff revision by the next Congress, but to aid the Tariff Commission by freely providing their cost figures to enable the commission to judge rightly the tariff requirements on imported products. At present, Mr. Nicholson said, not more than one-third of the foreign electrical materials brought into this country are shown as such in the published import totals, the rest being included in catch-all clauses of the tariff and shipped in disassembled or as parts under various classifications.

Addresses on industrial illumination, labor problems and the procurement of electrical supplies by the United States Army Signal Corps and the announcement of the "James H. McGraw awards" were other features of the program.

Scholarship Awards of Lighting Educational Committee

The Lighting Educational Committee has made arrangements by which the National Bank of Commerce in New York will act as trustee for the disposition of the ten scholarship awards, totaling $6,000, which were won in the recent home-lighting essay contest conducted by the committee.

The National Bank of Commerce is handling this account free of charge and the regular rate of interest paid by the bank for such moneys deposited will be made in the final payment in each instance. The prize winners of these scholarships were announced in the ELECTRICAL WORLD for January 3, page 60.

Refrigerator Manufacturers Ready to Organize

On the invitation of J. Robert Crouse, well known to electrical men for his former association with the incandescent-lamp industry and called "the father of co-operative development in the electrical industry," about forty representatives of the four leading manufacturers of electric automatic domestic refrigerators met very recently at Camp Cromaine, on Walden Lake, Hartland, Mich., the ancestral farm of the Crouses, and took steps toward the organization of the electric refrigerator industry for co-operation and development. There were included in the party the presidents, general managers, sales managers, chief engineers, advertising managers, works managers, service managers and some of their assistants representing the Nizer Corporation and the Kelvinator Corporation of Detroit, the Frigidaire organization of the Delco Light Company, Dayton, and the Servel Corporation, New York. There were present also George E. Miller, Cleveland Electric Illuminating Company, chairman of the refrigeration committee of the National Electric Light Association; F. M. Feiker, vice-president Society for Electrical Development, and Earl E. Whitehorne, commercial editor ELECTRICAL WORLD.

J. Robert Crouse was elected chairman and authorized to carry forward the organization of a refrigerator association, with the idea that the presidents of the member companies should form an executive committee with general managers, chief engineers, works managers, advertising managers and other officials working together as functional committees. Meetings are to be held twice a year at Walden Woods, and immediate measures will be taken toward the promotion of practical standards for the industry and the elimination of waste and destructive competition.

Saratoga A.I.E.E. Program

Excellent Technical Papers in Mornings, with Recreation and Trips in Afternoons

PROGRESS in many branches of electrical engineering, including generation, transmission and distribution, electrophysics, magnetism, hydro-electric development, power stations, lighting, communication, industrial applications, electrochemistry, electrometallurgy, electrical measurements, marine applications, machinery, circuit breakers, protective devices, research and standards, will be well covered in the technical papers and committee reports to be submitted at the annual convention of the American Institute of Electrical Engineers, to be held at Saratoga Springs, N. Y., on June 22 to June 26 inclusive. The meetings will take place at the United States Hotel.

The technical sessions will, as previously stated in these columns, be held in the mornings, leaving the afternoons free for the recreation which Saratoga provides so abundantly. A trip to Schenectady to inspect the General Electric Company's works is scheduled for Wednesday afternoon. On that evening two addresses on hydro-electric development will be given. On other afternoons trips to the Adirondack Power & Light Company's plants, including the Amsterdam steam plant, the Sherman Island and Fort Green Island hydro-electric plants and the Rotterdam high-tension substation, will be made. On Thursday evening Dr. W. E. Wickenden, director of investigations for the Society for the Promotion of Engineering Education, will tell about his study of engineering education in various parts of Europe.

Monday, June 22, will be given up to registration and conferences.

Award of Institute Prizes

The A. I. E. E. committee on award of institute prizes, composed of L. W. W. Morrow, Percy H. Thomas and Donald McNicol, has reported to the directors the following awards:

The "transmission prize" for 1924 to R. D. Evans and R. C. Bergvall, authors of a paper entitled "Experimental Analysis of Stability and Power Limitations," which was published in the April, 1924, issue of the *Journal of the A. I. E. E.* Honorable mention to papers on "Lightning and Other Transients on Transmission Lines," by F. W. Peek, Jr., and "Corona Losses Between Wires at Extra High Voltage"—II, by C. Francis Harding.

The "first paper prize" for 1924 to Murray F. Gardner, author of a paper entitled "Corona Investigation on an Artificial Line." Honorable mention to papers on "The Prediction of Insulation Failures in Transmission Lines," by H. C. Hamilton and R. W. Chadbourne; "Power Supply for Central-Station Auxiliaries," by J. W. Dodge, and "Fault Finding in Power Transmission Lines," by S. Aronoff.

Program of Annual Convention of A. I. E. E.

SARATOGA SPRINGS, N. Y., JUNE 22-26, 1925

TUESDAY, JUNE 23

Morning. — President's address; award of Institute prizes. Technical Session: "Present State of Transmission and Distribution Developments," committee on power transmission and distribution (P. H. Thomas chairman); "Live Problems in Connection with Protection of Electrical System," committee on protective devices (H. R. Woodrow chairman); "Latest Design and Practice in Power Plants," committee on power generation (Vern E. Alden chairman); "Developments in Electrical Machine Design," committee on electrical machinery (H. M. Hobart chairman); "Precision Watt-Hour Meters and High-Frequency Measurement," committee on instruments and measurements (A. E. Knowlton chairman); "Activities in Research," committee on research (John B. Whitehead chairman).

WEDNESDAY, JUNE 24

Morning.—Technical Session: "Developments in Applying Electricity to Industrial Uses," committee on general power applications (A. E. Waller chairman); "Electricity's Progress in the Iron and Steel Industry," committee on applications to iron and steel production (F. B. Crosby chairman); "Advances in Use of Electricity in Mines," committee on applications to mining work (F. L. Stone chairman); "Rules and Personnel Problems of the Marine Field," committee on applications to marine work (L. C. Brooks chairman); "Progress in Diverse Lines of Electrochemistry and Electrometallurgy," committee on electrochemistry and electrometallurgy (George W. Vinal chairman); "A Year's Progress in Lighting," committee on production and application of light (G. H. Stickney chairman); "Recent Advances in the Communication Art," committee on communication (O. B. Blackwell chairman); "Revised Standards and the Organization of Standards Activities," standards committee (H. S. Osborne chairman).

Evening.—Public addresses on hydro-electric developments: "Power Possibilities at Muscle Shoals," Samuel S. Wyer, consulting engineer; "The 540,000-Hp. Hydro-Electric Development at Ile Maligne, Quebec," William S. Lee, vice-president and chief engineer Southern Power Company.

THURSDAY, JUNE 25

Morning. — Technical Session A: "Engineering and Economic Elements of Two-Phase, Five-Wire Distribution," P. H. Chase, Philadelphia Electric Company; "The Oil-Circuit-Breaker Situation from an Operator's Viewpoint," E. C. Stone, Duquesne Light Company; "The Quadrant Electrometer," W. B. Kouwenhoven, Johns Hopkins University; "A New Method and Means for Measuring Dielectric Absorption," R. E. Marbury, Westinghouse Electric & Manufacturing Company.

Technical Session B: "Separate Leakage Reactance of Transformer Windings," O. G. C. Dahl, Massachusetts Institute of Technology; "Transformer Harmonics and Their Distribution," O. G. C. Dahl, Massachusetts Institute of Technology; "A New Two-Phase-to-Six-Phase Transformer Connection," A. Boyajian, General Electric Company; "Resolution of Transformer Reactances Into Primary and Secondary Reactances," A. Boyajian, General Electric Company; "Losses in Iron Under the Action of Superposed Alternating-Current and Direct-Current Excitations," O. E. Charlton, Alabama Power Company, and J. E. Jackson, General Electric Company.

Evening.—Educational meeting.

FRIDAY, JUNE 26

Morning.—Technical Session: "Study of Time Lag of the Needle Gap," K. B. McEachron and E. J. Wade, both of General Electric Company; "Oscillograph Solution of Electromechanical Systems," C. A. Nickle, General Electric Company; "The Klydonograph and Its Application to Surge Investigations," J. H. Cox and J. W. Legg, both of Westinghouse Electric & Manufacturing Company; "Overvoltages on Transmission Systems Due to Dropping of Load," E. J. Burnham, General Electric Company; "The Loaded Submarine Telegraph Cable," O. E. Buckley, Bell Telephone Laboratories, Inc.

Rural Service in Iowa

State Section of N. E. L. A. Gives Day to Its Consideration—Other Timely Topics

THE Iowa Section of the National Electric Light Association and the Public Relations Section of the Iowa Electric Railway Association met in joint session at Waterloo, Iowa, on June 3, 4 and 5. One session was devoted exclusively to rural electrification problems, the discussion being led by Prof. Frank D. Paine of Ames College, the electrical engineer in charge of an experimental station at Garner, Iowa. Among the speakers from outside the state who addressed the convention were J. P. Clayton, vice-president Central Illinois Public Service Company of Springfield, Ill., who spoke on superpower developments; W. H. Onken, Jr., editor ELECTRICAL WORLD, New York, whose topic was "Progress of Electric Public Utilities," and F. C. Hush of the Nebraska Gas & Electric Company of Omaha, who talked about meter testing.

Don M. Sterns of Humboldt, president of the association, was most optimistic about the public utility outlook in Iowa. He declared that if the electrical industry be taken as a criterion, Iowa is on the verge of prosperous expansion. Many millions are being spent for machinery and equipment to take care of new business.

The trend toward general public ownership of public utilities by wide distribution of stock was discussed by F. P. Sammons of the United Light & Power Company, Davenport. Other speakers included Albion Davis of Keokuk, who spoke on "Safety"; F. J. Hanlon of Mason City, who reported on legal and legislative matters; Prof. C. F. Taeusch of Iowa City, who discussed standards of business conduct; George Myers of Sioux City, who told of the accounting department's customer contact, and R. O. Sutherland of Davenport, whose topic was "Modern Distribution Development." C. A. Nash of Davenport told of the value of the appliance business, and Walter McCue of Chicago spoke on improved lighting and the mutual benefits arising therefrom.

New officers were elected as follows: President, John A. Reed, vice-president Iowa Railway & Light Company, Cedar Rapids; vice-presidents, C. E. Fahrney of Ottumwa and C. S. Macy of Adel; secretary-treasurer, H. E. Weeks of Davenport. The directors elected are: D. M. Sterns, Humboldt; M. G. Linn, Des Moines; C. N. Chubb, Davenport; J. P. Walters, Toledo; H. Bellamy, Knoxville; S. C. Dow, Cedar Rapids; F. H. Brooks, Omaha; E. F. Buhlman, Centerville; R. H. Garrison, Waterloo; H. C. Orton, Dubuque, and F. J. Hanlon, Mason City.

Southern California Edison Appeals Water-Right Suit

An appeal was filed May 28 with the Supreme Court of California by the Southern California Edison Company asking to have the decision of the Superior Court of Fresno County in the Herminghaus case set aside. The Southern California Edison Company was enjoined by the lower court (see ELECTRICAL WORLD for February 21, page 419) from storing water in Huntington Lake on its Big Creek-South San Joaquin hydro-electric project, except that which is produced by the run-off in the Huntington Lake basin.

Suit was brought by the Herminghaus heirs against the power company to prevent the storage of water on the upper reaches of the San Joaquin River in such a manner as to affect the normal flow of the river and prevent spring floods from inundating the lowlands of the estate lying along the river in the San Joaquin Valley. Since the recent completion of Florence Lake Tunnel, the Edison company has not been permitted by the injunction granted to store water passing through the tunnel in Huntington Lake, but has been required to pass the water on through its chain of four plants on Big Creek and the San Joaquin.

In the present status of the matter the company is not only prevented from storing water in Huntington Lake brought through Florence Lake tunnel from reservoirs at Florence Lake, Vermilion Valley, Shaver Lake and Blaney Meadows on the so-called east side development, but is also enjoined from storing water in a number of contemplated reservoirs on the west side development, not yet undertaken.

Alabama Power Wins Prize

"Forbes Magazine" Public Service Cup for Constructive Work Goes to Birmingham Company

THE *Forbes Magazine* public service cup has been awarded to the Alabama Power Company in a national contest conducted to determine which light and power company in America rendered the most constructive public service in local territory in 1924. The award was made after hundreds of exhibits had been examined by the judges, who were Bruce Barton of Barton, Durstine & Osborn; Thomas F. Logan of Thos. F. Logan, Inc.; Philip Thompson, publicity manager Western Electric Company; Louis Wiley, New York *Times;* M. Z. Robbins, *Advertising Fortnightly;* A. R. Dickinson, *Printer's Ink,* and B. C. Forbes, editor of *Forbes Magazine.* The cup and certificate of award will be formally presented to the company by Mr. Forbes at the San Francisco convention of the National Electric Light Association on the night of June 17.

The committee was greatly impressed with the variety of methods employed by the winning company, but was prompted chiefly in its decision by the actual results accomplished. The company laid little stress upon the various agencies it employed in rendering service, but in a comprehensive manner told the story of its achievements. The work of the company in "boosting" its home state irrespective of the territory it serves, its efforts to be of material service to the farmers by extending its lines to rural communities and, without renumeration to itself, making available calcium arsenate for the eradication of the boll weevil were outstanding and unique contributions to service. The company's success in inducing those it serves to invest their savings in its securities and its contributions to educational institutions also played no little part in winning the coveted honor.

The winners of the second and third prizes were the Nebraska Power Company of Omaha and the Consumers Power Company of Jackson, Mich.

Beck Assails Carillon Plan

Chairman of Ontario Commission Sure United States Wants to Grab Canada's Water Power

SIR ADAM BECK, chairman of the Ontario Hydro-Electric Power Commission, has issued a statement in which he characterizes the terms of the proposed lease of water-power rights at Carillon on the Ottawa River as "scandalous." The burden of his statement is that no further exportation should be permitted, or at least that a prohibitive export tax should be levied.

Sir Adam draws attention to the fact that although the Carillon site is thought capable of furnishing only 200,000 hp., the lease seeks to establish the right to export twice that quantity of power. He asserts that the Carillon lease with its exportation rights is not merely the entering of the thin end of the wedge by means of a change in the law governing the exportation of electricity, but is a complete breaking down of the barrier which heretofore has been a reasonable safeguard to the people of Canada, serving notice annually on all users of Canadian-produced electricity that this commodity is only being exported from the country until such time as the need arises for its use in Canada.

"The citizens of Ontario," Sir Adam says further, "are now facing a most serious power shortage. Its gravity can scarcely be overstated. Within the short period of fifteen years Ontario will need every horsepower that can be developed from its water powers and the markets will absorb this power as rapidly as it can be produced." Averring that New York State now controls a possible development of about 1,000,000 hp. from the St. Lawrence, Sir Adam remarks: "It is most significant to inquire why the United States authorities do not go on with the development of this St. Lawrence power to supply the urgent demands in the United States, instead of having the United States hammering to break down the barrier at present holding in safeguard Canada's electricity for the present and future use of Canadian communities and industries."

With respect to a recent article in the New York *Times* declaring that a program is on foot to pool the water-power resources of the United States and Canada, Sir Adam says: "The proposed export of 400,000 hp. from the Carillon development is simply the first step in carrying out this gigantic program of making Canada's powers the source from which electrical energy is to be permanently exported to the United States for building up the communities and industries of that country."

Asked in the House whether the government intended to grant the application of the Ontario government and the Hydro-Electric Power Commission to develop power at Morrisburg, the Minister of Railways and Canals replied that the plans have not yet been approved.

Briefer News

Andalusia Company Joins Alabama Power System.—The Andalusia Light & Power Company, formerly owned by J. N. McClung, has been taken over by interests allied with the Alabama Power Company. The holding company is headed by T. E. Henderson of Andalusia. W. M. Stanley will be manager.

Chicago Asks Rehearing on Lake Diversion.—Averring that several issues had been construed erroneously by the court, a petition for rehearing of the Lake Michigan diversion case was filed in the United States Supreme Court June 1 by attorneys representing the Sanitary District of Chicago. Motion for rehearing was denied, thus finally disposing of the case.

Porto Rico Has Engineering Association.—The Association of Mechanical and Electrical Engineers of Porto Rico has been formed at San Juan, P. R., and has just issued its first yearbook, giving the constitution of the association as adopted on April 10 last. Officers are: Chairman, Horace E. Setchell; vice-chairman, Frederick Krug; secretary, H. L. Talbot; treasurer, Roscoe I. Dunten; members executive committee, Ignacio Fiol and H. J. McCabe.

A. I. E. E. Sections at Boston and Indianapolis Elect Officers.—The Boston Section of the American Institute of Electrical Engineers has elected W. R. McCann chairman, J. W. Kidder vice-chairman and W. H. Colburn secretary and treasurer for 1925-26. The Indianapolis - Lafayette Section has elected V. T. Mavity of Indianapolis chairman, Prof. L. D. Rowell of Lafayette vice-chairman and J. Bowen Bailey of Indianapolis secretary and treasurer.

Kentucky-Tennessee Company Buys Mayfield City Plant.—Announcement is made at Bowling Green, Ky., from the headquarters of the Kentucky-Tennessee Light & Power Company of the completion of a deal whereby that company takes over the Mayfield (Ky.) city plant at a price of $605,000. This purchase gives the Kentucky-Tennessee Light & Power Company control over twenty-three light, water and power plants in Kentucky and northwest Tennessee.

Mine Bureau Taken Over by Department of Commerce.—The Bureau of Mines was transferred by executive order of President Coolidge last week from the Interior Department to the Commerce Department, and Secretary of Commerce Hoover announced that he would take action immediately to render the service of the bureau to the mining industry more effective. The Mineral Statistics Section of the Geographical Survey also was transferred to Secretary Hoover's jurisdiction. These transfers are another step in the plan of government departmental reorganization long advocated by the engineering associations of the nation.

Western Reserve Company Plans to Purchase Ohio Plants.—The Western Reserve Power & Light Company of Cleveland has applied for permission to purchase for $245,000 the high-tension lines belonging to the East Ohio Power & Light Company and the Cleveland Southwestern Railway & Light Company. The Western Reserve company plans to take over high-tension lines and property of the Cleveland Southwestern in Nova, West Salem, Sullivan and Spencer. Since its reorganization the Cleveland Southwestern Railway & Light Company has acquired control of four light and power companies which will be operated by the Western Reserve company.

Metropolitan Section, N. E. L. A., Has Safety Rally.—One thousand foremen from public utility electric light plants in and about New York City attended the second annual safety rally held recently in the Engineering Societies Building by the Metropolitan Section of the National Electric Light Association. The meeting was conducted by W. H. Warner, chairman of the section's accident prevention committee. A demonstration of the Schaefer prone-pressure method of resuscitation was given under the supervision of E. P. Durfee by sixteen girls trained by the United Electric Light & Power Company to act as instructresses, and Dr. William T. Dorward spoke on "The Master Key of Safety." In the picture President Frank W. Smith of the United company is seen presenting to H. Y. Hall, superintendent of that company's Hell Gate station, a safety banner won against the Sherman Creek station in an accident contest based on lost time.

Connecticut Electric Service Company Incorporated. — The Connecticut Electric Service Corporation charter, referred to in the ELECTRICAL WORLD for May 23, page 1091, has passed the Senate and House of Representatives at Hartford and will receive the signature of Governor Trumbull. As previously stated, this is to be a transmission and holding company designed to receive and distribute energy to utilities and is intended to facilitate the distribution of St. Lawrence power when it becomes available to Connecticut.

Consumers Power Company to Absorb Greenville (Mich.) Plant. — The Consumers Power Company has purchased the Tower Electric Light Company, whose plant is situated at Greenville on the Flat River, 18 miles east of Grand Rapids, at a price alleged to be $300,000. The Tower company was formerly operated by R. J. Tower, and served several small villages within a radius of about 40 miles. It will now be controlled through the Alma office of the Consumers company.

University of Florida Meter Course. —Seventy-six men attended the third meter course of the University of Florida at Gainesville in April and May, representatives of central-station companies in Alabama and Georgia as well as Florida taking the course, which was both practical and theoretical. It was held in connection with the College of Engineering, of which J. R. Benton is dean and professor of electrical engineering. This is the only meter school in the East south of Raleigh, N. C.

American Electric Power Company Purchases Rockymount Plant. — The American Electric Power Company of Philadelphia has purchased the Rockymount (Va.) Light & Power Company, which was organized in 1908 to develop a small hydro-electric generating plant on Pig River. The American Electric Power Company owns the Roanoke Railway & Electric Company and the Lynchburg Traction & Light Company and will eventually build a transmission line from Rockymount to Roanoke, a distance of 20 miles.

Seattle Discontinues Attempt to Sell Power Outside City Limits. — Following the filing of a suit in the Superior Court at Seattle by the Puget Sound Power & Light Company to prevent that city from selling power outside its corporate limits, Superintendent of Lighting J. D. Ross appeared before the court and announced that he would make no further attempt to sell power outside the city limits. He said the contract with the Savage Lumber Manufacturing Company of Renton, of which the power company complained, had been canceled. The case will be heard on its merits at a later date, a temporary restraining order continuing in effect.

Los Angeles Has Spectacular Lighting Display.—One of the largest and most elaborate lighting spectacles ever designed was that displayed last week in Los Angeles in connection with the session of the Nobles of the Mystic Shrine. The main feature of the decorative and lighting scheme was the conversion of the Los Angeles Stadium, which seats 77,000 people, into an enormous Moorish palace, covered with latticework and studded with spray-coated lamps. Designs for the lighting effects, which required thousands of colored lamps and many large floodlighting units, were prepared by the Westinghouse Lamp Company.

Northern Indiana Gas & Electric Occupies New Building.—The Northern Indiana Gas & Electric Company has moved into its new three-hundred-thousand-dollar office building, which is three stories high and covers an L-shaped area of 8,450 sq.ft., with frontage on two streets. It is built of Indiana limestone and brick. The structure is occupied exclusively by the company and is designed to permit two additional stories should more space be required. Powerful floodlight projectors illuminate the two façades of the building at night.

Permanent Searchlight Illumination of Niagara Is Dedicated.—Formal dedication of the permanent 1,440,000-cp. searchlight illumination of Niagara Falls took place on Monday night with Lieutenant-Governors Seymour Lowman of New York and John Cockshutt of the Province of Ontario as the principal figures in the dedication ceremonies. As the two officials clasped hands at the center of the International Bridge a rocket gave the signal for unveiling the searchlight battery on the Canadian shore. Thousands lined the American and Canadian banks to see the spectacle.

Oklahoma State Highway Department Sanctions Transmission-Line Rights-of-Way on Public Roads. — Whether high-tension transmission lines may be built on state highways—a question of great importance to light and power companies in Oklahoma—has been answered in the affirmative by the Highway Department of that state, which asserted its jurisdiction when appeal was made to it from a majority decision of the Carter County Board of Commissioners permitting the Consumers' Light & Power Company to build a 30-mile line from Ardmore. Only one county commissioner objected and it was his appeal to the State Highway Department that brought the assumption of jurisdiction and the decision noted.

Merger of Six Central Missouri Plants.—The electric light and power plants in six central Missouri towns—Moberly, Huntsville, Boonville, Higbee, Kirksville and La Plata — are, by authority of the Missouri Public Service Commission, to be merged in the Central Missouri Power & Light Company, with headquarters at Kirksville, succeeding the Adair County Light, Power & Ice Company of that place. The other companies to be taken over—all being controlled by the Missouri Power & Light Company of Mexico—are the Moberly Light & Power Company, Huntsville Light & Power Company, La Plata Light, Heat & Power Company, Citizens' Electric Light Company, Higbee, and Boonville Light, Heat & Power Company.

More New York Power Company Mergers Planned.—The Central Hudson Gas & Electric Company has asked permission of the New York Public Service Commission to acquire all outstanding stock of the Citizens' Railroad, Light & Power Company and the outstanding stock and mortgage bonds of the Southern Dutchess Gas & Electric Company, both of Beacon, N. Y., and to merge these companies. It desires also to purchase the stock of the Fishkill Electric Railway Company. The Katonah (N. Y.) Lighting Company has petitioned the commission for a transfer of the franchises, works and system of its electric plant to the Harlem Valley Electric Corporation, which joins in the petition and asks leave to erect an electric plant in the municipalities.

Hydro-Electric Plant at Chelan Falls, Wash., May Be Built to Aid Railroad Electrification.—Installation at Chelan Falls, about 120 miles northeast of Seattle, of one of the largest hydro-electric power plants in the State of Washington, one that will develop 65,000 hp. and that may involve an investment of $10,000,000, is rumored as an approaching enterprise. The Great Northern Railway Company acquired the Chelan Falls power site about fifteen years ago. It is reported that the railway company plans to close negotiations for the sale of the power rights to the Washington Water Power Company as part of a contract under which the Spokane company will supply power for the future electrification of the Great Northern lines. Neither railroad nor power company officials would confirm the report, although neither denied it.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

Pacific Coast Electrical Association (Geographic Division N. E. L. A.)—San Francisco, June 15. S. H. Taylor, 529 Rialto Bldg., San Francisco.

National Electric Light Association—San Francisco, June 15-19. M. H. Aylesworth, 29 West 39th St., New York.

Society for the Promotion of Engineering Education — Union College, Schenectady, N. Y., June 17-20. F. L. Bishop, University of Pittsburgh, Pittsburgh.

National Council Lighting Fixture Manufacturers and National Association of Lighting Equipment Dealers—The Ambassador, Atlantic City, June 17-19. Herman Plaut, 432 E. 23d St., New York.

American Society of Agricultural Engineers—Madison, Wis., June 22-25.

American Society for Testing Materials—Chalfonte-Haddon Hall Hotels, Atlantic City, N. J., June 22-26. C. L. Warwick, 1315 Spruce St., Philadelphia.

American Institute of Electrical Engineers—United States Hotel, Saratoga, N. Y., June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Michigan Electric Light Association—Grand Hotel, Mackinac Island, June 25-27. Herbert Silvester, 401 South Main St., Ann Arbor, Mich.

Empire State Gas and Electric Association (Commercial Section)—Schenectady, June 25-26. C. H. B. Chapin, Grand Central Terminal, New York.

East Central Division, N. E. L. A.—Breakers Hotel, Cedar Point, Ohio, July 14-17. D. L. Gaskill, Greenville, Ohio.

North Central Division, N. E. L. A.—Duluth, Minn., July 15-17. H. E. Young, Minneapolis General Electric Co., Minneapolis.

International Association of Municipal Electricians—Hotel Statler, Detroit, Aug. 17-20. W. R. Arbuckle, Bayonne, N. J.

New England Division, N. E. L. A.—Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Southeastern Geographic Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

Bloomfield, Neb., Votes for Municipal Plant.—A special election at Bloomfield, Neb., to decide whether or not a municipal electric light and power plant should be installed by the city decided in its favor by a vote of 360 to 66.

Paul Smith Adirondack Power Plant Changes Hands.—It is announced that John I. Mange of New York City, president of the Associated Gas & Electric Company, has purchased the interests of Paul Smith in the Paul Smith Hotel Company and the Paul Smith Electric Light, Power & Railway Company. The electric developments include power plants at Franklin and Union Falls on the Saranac River, in the Adirondack mountain region of New York State, and another now under construction at the Racquette Falls on the Racquette River. Other water-power rights are included.

Iowa Governor Appoints Commission to Study Relation of Industry to Agriculture.—Believing that Iowa and the other states of the Middle West must seek a proper balance of agriculture with industry if they are to maintain their prosperity, Governor John Hammill of Iowa has appointed a representative commission to determine what can be done along such lines. Chief Justice Faville of Fort Dodge is chairman and Arthur Huntington of the Iowa Railway & Light Company, Cedar Rapids, is a member of the commission. The part that electricity may play in the development of industry in the agricultural states and in improving the productive capacity of the farm is expected to receive careful consideration.

Work on Wisconsin's Largest Transmission Line Begun.—The beginning of construction on Wisconsin's largest power transmission line by the Wisconsin Gas & Electric Company is announced by the North American Company, the holding concern. The line will be completed this year, and on its completion 200 miles of high-voltage transmission line will interconnect the Lakeside steam-electric station at Milwaukee with the plants of the Peninsular Power Company in northern Michigan. "These lines consist of three aluminum wires more than a half-inch in diameter, carried on steel towers spaced from 600 ft. to 1,000 ft. apart," said President F. L. Dame of the North American Company. "Operating at 132,000 volts, this transmission project will rank among the longest and the largest-capacity lines in the country. When these lines are completed the North American system will be able to bring surplus energy from its northern Michigan hydro-electric stations into greater Milwaukee and the Fox River valley. Power from Lakeside can be called upon to serve upper Michigan during periods of low water. Thus both water power and coal will be conserved, and eastern Wisconsin will have a bigger power reserve."

Men of the Industry

O. C. Merrill, executive secretary of the Federal Power Commission, will be awarded the honorary degree of doctor of science by Bates College, Lewiston, Me. Mr. Merrill was valedictorian of the 1899 class of this institution, where he also took honors in mathematics.

Seton Porter, of Sanderson & Porter, was elected a director of the American Water Works & Electric Company at the recent annual meeting to fill the vacancy caused by the resignation of Edward R. Tinker.

Major James R. Werth, manager of the Poteau district of the Oklahoma Gas & Electric Company, has in addition to his other duties received the appointment of commercial agent of the Fort Smith Light & Traction Company, with headquarters at Fort Smith, Ark.

John C. Campbell, formerly a member of the treasury department of the Pacific Power & Light Company, Portland, Ore., has been appointed manager of the investment department of the Memphis Power & Light Company, Memphis, Tenn.

George D. Baxter, manager of the Exeter & Hampton (N. H.) Electric Company, has been elected president of the Tenney Service Association, an organization of resident executives of properties under the management of Charles H. Tenney & Company, Boston.

R. L. Melvin, for the past eighteen months on the sales staff of the Haverhill (Mass.) Electric Company, has been appointed sales manager of the Montpelier & Barre Light & Power Company, with headquarters at Montpelier, Vt. Both companies are managed by Charles H. Tenney & Company, Boston.

Clark P. Spellman, formerly distribution engineer with the Lowell (Mass.) Electric Light Corporation, has been transferred to the El Paso (Tex.) Electric Railway Company. These two utilities are under the management of Stone & Webster.

L. H. Rosenberg, formerly connected with the publicity department of the Westinghouse Electric & Manufacturing Company, has been appointed manager of the sales promotion department of the Westinghouse Lamp Company. Mr. Rosenberg recently served as publicity man for the National Educational Lighting Campaign, his services having been loaned to that organization by the Westinghouse company.

W. A. Hillebrand, district engineer for the Pacific Coast Division of the Ohio Brass Company since 1919, has been transferred to Barberton, Ohio, where he will assume the position of electrical engineer for the Ohio Insulator Company, the clay department of the Ohio Brass Company. He is bringing to his new position great experience in high-voltage transmission problems which will prove particularly valuable. After spending seven years on the teaching staff of Stanford University and the Oregon Agricultural College, in 1914 Mr. Hillebrand entered the distribution department of the Pacific Gas & Electric Company, remaining until 1918, when he became identified with the Federal Telegraph Company at Palo Alto, Cal. It was in the following year that he became associated with the Ohio Brass Company on the Pacific Coast. He has been an active and prominent member of the American Institute of Electrical Engineers for many years.

D. H. Braymer Resigns from "Industrial Engineer"

Daniel H. Braymer has resigned as editorial director of the *Industrial Engineer* in order to devote the major part of his time to the activities of the recently organized D. H. Braymer Equipment Company. He will retain his connection with the McGraw-Hill Company as consulting editor of the *Industrial Engineer* and will continue to

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contribute advice and material to the publication. Mr. Braymer has long been interested in the power problems of the industrial plant as a McGraw-Hill editor and now has decided to withdraw from executive editorial tasks to engage directly in engineering sales service to power users. His newly organized company will have its headquarters in Omaha and will specialize in consulting and sales work associated with power applications in industrial plants, large buildings and power plants. The company will act as the authorized representative of several manufacturers of related power equipment in the States of Nebraska and Iowa and the cities of St. Joseph and Kansas City, Mo. Marvin Philips will be associated with Mr. Braymer as installation engineer.

The career of Mr. Braymer fits him admirably for his new occupation. He was born in New York State and completed his engineering education at Cornell University. After graduation he was associated with the Westinghouse Electric & Manufacturing Company, the Electrical Testing Laboratories and the Western Electric Company. While with the Western Electric Company he became interested in editorial work and left to take an editorial position with the *Southern Electrician.* In 1915 Mr. Braymer became associated with the McGraw-Hill Company as engineering editor of the ELECTRICAL WORLD. With the exception of two years' service as editor of the *Electrical Record,* Mr. Braymer retained his association with the ELECTRICAL WORLD, in later years as managing editor and co-editor, until the *Electrical Review* was purchased by the McGraw-Hill Company. With that purchase Mr. Braymer obtained an opportunity he had long desired. He was placed in charge of both the publishing and editorial policies of the newly purchased magazine, which started on its present career as the *Industrial Engineer,* having headquarters in Chicago. He has made a notable success as editorial director of the *Industrial Engineer,* and a host of friends wish him even greater success in his new undertaking.

Carl H. Hermance has recently joined the California State Railroad Commission as assistant engineer.

Norman B. Hickox, for several years past assistant general sales manager, has been made vice-president in charge of sales of Curtis Lighting, Inc., Chicago.

M. F. Treadwell, formerly manager of the San Angelo (Tex.) Light & Power Company, has recently been transferred to Clearwater, Fla., where he is manager of the Pinellas County Power Company.

Edward J. Otterbein, formerly connected with the sales department of the Cedar Rapids (Iowa) Gas Company, has been appointed sales manager of the People's Light Company of Davenport.

W. D. De Wolf has been appointed assistant electrical superintendent in direct charge of maintenance, construction and operation of the electrical department of the Rochester (N. Y.) Gas & Electric Corporation.

C. R. Winkler, formerly power salesman for the Arkansas Central Power Company, Little Rock, is now in charge of the commercial department of the Jackson Railway & Light Company, Jackson, Tenn.

L. W. Heller has resigned from the position of general superintendent of power stations of the Duquesne Light Company of Pittsburgh to accept the position of general engineer with the Bailey Meter Company, Cleveland.

Robert M. Springfield has been recently elected secretary of the Public Service Commission of Georgia, succeeding Albert Collier, who has been secretary of this commission for the past nine years. The change became effective June 1.

A. E. Asklund, formerly associated with the Texas Power & Light Company, Dallas, as electrical engineer, has affiliated himself with the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Egerton Shore, member of the California State Railroad Commission, has tendered his resignation to Governor Richardson, effective July 1, 1925. Mr. Shore served for two years on the State Board of Control and was ap-

pointed by former Governor Stephens to the Railroad Commission on January 1, 1923, for the term expiring December 31, 1926. Mr. Shore's resignation is due to the growth of his business affairs in Los Angeles, where he is president of Shore Brothers Company, a corporation engaged in real estate, building and mortgages.

Frank B. Jewett, vice-president of the American Telephone & Telegraph Company and a past-president of the American Institute of Electrical Engineers, was awarded the honorary degree of doctor of science by New York University at the commencement exercises held June 10.

S. V. Abramson, formerly connected with the commercial department of the Merchants' Heat & Light Company, Indianapolis, has been appointed commercial manager of the Northern Indiana Power Company, Huntington.

L. P. Perry, general commercial manager of the Central Hudson Gas & Electric Company, Poughkeepsie, N. Y., has resigned to join the Metropolitan Edison Company, with headquarters at Reading, Pa.

N. E. Carter of the Oklahoma Gas & Electric Company's Enid office has been awarded an Insull medal for services performed at the company's Cushing substation in June, 1923, in the resuscitation of B. B. Easter, a lineman. Mr. Carter has been at Enid one year, having been transferred to that office from Sapulpa.

J. J. Raftery has resigned as Eastern general manager of the Manhattan Electrical Supply Company, New York City, where he had direction of domestic and export sales. Mr. Raftery was formerly in sales and sales executive work for the Western Electric Company in Newark and New York City.

B. B. Ramey, who has been for the past twelve years with the Westinghouse Electric & Manufacturing Company as designing and section engineer at the East Springfield works, has resigned to become electrical engineer with the Black & Decker Manufacturing Company, Towson, Md.

J. G. Miller, since 1921 engineer in the valuation department of the Southern California Edison Company, Los Angeles, has been appointed power engineer for the American Trona Corporation, Trona, Cal., one of the largest manufacturers of potash, borax and similar chemicals in the United States. Mr. Miller will be in charge of steam generation, refrigeration and the generation and distribution of electric power.

George A. Muir, who has been connected with the Denver office of the Allis-Chalmers Manufacturing Company for the past five years and for ten years previous to that with the machinery department of the Mine & Smelter Supply Company, Denver, has been elected to the office of president and manager of the Advance Machinery & Supply Company, jobbers' and manufacturers' agents and themselves manufacturers of steam and electrical specialties with offices in Denver.

Alfred G. Paulsen, formerly manager and chief engineer of the Cia de Electricidad de Merida, Yucatan, Mexico, is now general manager of the Venezuela Electric Light Company, Ltd., Caracas, Venezuela. Both these companies are controlled by the International Light & Power Company, Ltd., of London, England.

O. E. Sinclair, formerly valuation engineer of the Public Service Company of Northern Illinois, has been appointed engineer of electrical distribution construction of that company. Mr. Sinclair studied electrical engineering at the University of Illinois and has been identified with the Public Service Company since 1914, with the exception of two years spent in military service. In January, 1924, he was made valuation engineer and from that place was promoted to his present position.

Ira W. Fisk and **Edward A. Roberts** have formed a partnership under the name of Fisk & Roberts, New York, and are specializing in management and engineering service for power and transportation companies. Mr. Fisk was formerly general manager of power and light properties at Springfield, Ill. Mr. Roberts still retains the management of the three railway companies serving Queens and Nassau Counties, New York.

John G. Brown, Jr., of Meriden, Conn., sailed last week from New York for South America to take over the management of the lighting division of the International General Electric Company in Chile. Mr. Brown was graduated from the mechanical and electrical engineering department of Tufts College and had his early experience at the Miller Company plant in Meriden.

S. L. Pearce, C.B.E., the chief of the Electricity Supply Department of the Corporation of Manchester, one of the most important of such undertakings in England, has been invited by the British government to become a member of the Electricity Commission engaged on a national scheme for developing and cheapening electricity supply in the United Kingdom. Mr. Pearce only recently returned from Australia, having been "loaned" by the Manchester Corporation to that of Sydney in connection with the extension of electricity supply in the last-named city.

Obituary

William Duncan of the Duncan Electrical Company, Ltd., died June 1 at his home in Montreal after a long illness. He was forty-nine years of age. Born in Sherbrooke, Quebec, Mr. Duncan in early manhood moved to Boston, where he entered the electrical business. More than twenty years ago he returned to Canada and became associated in affairs with his brother, Charles Duncan, managing director of the Duncan Electric Company, Montreal.

Major William H. Wiley, treasurer of the American Society of Mechanical Engineers since 1884, died at his home in East Orange, N. J., May 2, in his eighty-third year. A native of New York, Mr. Wiley had engaged in technical and scientific publishing since 1873. His military title dates back to the Civil War, in which he served with distinction. In addition to holding the treasurership of the American Society of Mechanical Engineers, Major Wiley was an active member of the American Institute of Electrical Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers and the Engineers' Club of New York.

Clifton D. Kennedy, chief instructor and electrical director of the National Auto and Electrical School, Los Angeles, died in that city May 15. Mr. Kennedy was a native of Denver, Col., and a graduate of the Naval Engineering School. After receiving an honorary discharge from the navy in 1912 he joined the Cramp Shipbuilding Company. Later he was affiliated successively with the Philadelphia Navy Yard, the Walker & Kepler Electric Company, the United Construction Company, the Western Electric Company, the Edwin G. Budd Manufacturing Company, the Midvale Steel Works, the Reading railroad and the Westinghouse Electric & Manufacturing Company. Mr. Kennedy was the author of seventy-two published lectures on alternating-current equipment. He was a member of the American Institute of Electrical Engineers.

Prof. Mansfield Merriman, nationally known engineer and past-president of the Society for the Promotion of Engineering Education, died at his home in New York June 7 in his seventy-eighth year. A graduate of Yale, class of 1871, and the recipient of honorary degrees from other universities, Professor Merriman was the author of many standard engineering texts. He was a member of the New York Academy of Science, the American Association for the Advancement of Science, the American Society of Civil Engineers and the Engineers' Club of New York.

Arthur Jacob of Hatch End, Middlesex, England, died there April 3 in his fifty-seventh year. Mr. Jacob was born in Dublin, Ireland, and received his technical education at the Royal College of Science. In 1889 he associated himself with Dr. S. Z. de Ferranti, F. R. S., then engineer-in-chief of the London Electric Supply Corporation, Ltd. Subsequently he was made resident engineer of the Electricity Supply Company for Spain, Ltd., at Madrid as well as for the British Thomson-Houston Company, Ltd., London. He later became manager of the British Schuckert Electric Company, Ltd., in charge of the central-station department of the Siemens Brothers Dynamo Works, Ltd., at London. In 1908 Mr. Jacob became interested in the management of the British Aluminium Company, Ltd., with which he was affiliated at the time of his death. He was a member of the Institution of Electrical Engineers, the overhead wires committee of the British Engineering Standards Association, the overhead wires committee of the British Electrical Research Association, the American Institute of Electrical Engineers and the American Electrochemical Society.

Commission Rulings

Permission to Light Apartment House from Central Plant Independent of Public Utility Denied. — Application was made recently to the New York Public Service Commission by the Lawrence Park Heat, Light & Power Company of Bronxville, owned by the Lawrence Investing Company, for permission to extend the heating plant now owned by it and already used for heating and lighting the Hotel Gramatan to twelve new apartment houses about to be built to accommodate 350 tenants in the vicinity of the hotel. This company maintained that the steam it would use to heat the apartment houses could also manufacture electricity almost as a by-product, thereby saving expense to tenants. The application was opposed by the Westchester Lighting Company, which said that it had poles and wires in all of the streets which would be served by the Lawrence Park company if the extensions asked were approved and that granting of the application would admit the Lawrence Park company to competition with the Westchester company. The Westchester company claimed that it would enable the Lawrence Park company to take the most profitable business in the more fully developed area of Bronxville. The commission last week sustained the Westchester company's contention, granting to the Lawrence Park company permission to extend its steam mains but not its electric service, for both of which the company had obtained franchises. The decision is of much importance in its effect upon electric service to real estate developments such as the one contemplated in Bronxville, inasmuch as it denies to a realty development company any right to supply electricity to its tenants in competition with an existing public utility corporation.

Proper Requirements for Rendering Service to Summer Camps.—The Massachusetts Department of Public Utilities in adjudicating a complaint made by John Peavey against the regulations imposed by the Lowell Electric Light Corporation as a condition of serving summer camps approved the rule of the company requiring them to make an initial deposit of $15 and guarantee a consumption of $24 a year. "We feel," the commission said, "that there is no reason why the petitioner should get the benefit of this general plan of extension without bearing his share of the burden. We entertain no doubt that the company ought not to be ordered to furnish him service unless he guarantees consumption of $24 a year. We are not so clear as to the deposit of $15. The company is undoubtedly justified in demanding a reasonable deposit. Fifteen dollars is not an excessive requirement, in our judgment, from the seasonal occupants of summer camps. It may be questioned, perhaps, whether it is not too high for permanent residents who own their own homes. If the company desired to make a distinction on this basis, there would be much, in our judgment, to commend it. On the other hand, we do not feel that we can properly say that the company is acting unreasonably in refusing to draw distinctions between those who rent summer camps, those who own summer camps, those who rent houses along the Turnpike and those who own houses along the Turnpike."

Permission to Construct Transmission Line Through a City Not Given When Line Is to Serve Another City.—The Calumet Gas & Electric Company requested from the Indiana Public Service Commission a certificate of convenience and necessity to construct a transmission line through the city of Hobart, Ind., and authority to condemn private property for right-of-way. Hobart is served by a municipal plant, and the line was to be built through Hobart instead of around it as a matter of economy in order to serve Valparaiso. The city of Hobart objected to this because the Calumet company served only one or two large power customers in Hobart and the authorities felt that an extension of the line through Hobart might endanger the welfare of the municipal plant. The commission, sustaining the protest, refused permission to the company to build the line through Hobart since it was not to serve that city and stated that the additional expense of building around Hobart would have to be borne by those who benefited by it.

Recent Court Decisions

Company Held Chargeable with Knowledge of Danger from Sagging Wires Along Highway.—In the case of Langevin vs. Twin State Gas & Electric Company the Supreme Court of New Hampshire found that the company should have recognized the danger from poorly insulated and sagging wires along a bridge where boys had long been accustomed to fish. The plaintiff had halted for a moment on the bridge to watch the boys when one of them caught his line in the low, sagging wires and pulled them together causing a short circuit. The wires burned off and fell on the plaintiff, standing below, injuring him. The company maintained that the injuries were due to the act of the boy fishing, but the court held they were due to the poor condition of the lines along a public highway. (128 At. 681.)*

Supreme Court Overrules Municipal Ordinances Affecting Deposits on House-to-House Sales.—By a recent finding of the United States Supreme Court municipalities cannot impose onerous restrictions upon house-to-house solicitors who canvass for orders for merchandise which moves in interstate commerce and who accept a deposit on such orders. The decision is said to nullify most of the ordinances of the more than eight hundred cities in thirty-eight states which have such local legislation and to constitute a substantial victory for direct selling methods. The case at issue was the appeal of the Real Silk Hosiery Mills, Inc., of Indianapolis from decisions of the Oregon state courts upholding an ordinance of the city of Portland which required that solicitors who accept a deposit on orders should obtain a license from the city and file a bond. This was a test case, supported by numerous manufacturers and merchants interested in direct selling and by magazines and newspapers. In an opinion by Justice McReynolds, the Supreme Court has held the ordinance unconstitutional as violative of the commerce clause.

Consumer Required to Pay for Energy According to Established Rate Schedule.—The Supreme Court of Pennsylvania, in the case of Westerhoff Brothers Company vs. Borough of Ephrata, refused to restrain the municipal electric plant of Ephrata from requiring that electrical energy furnished to Westerhoff Brothers Company's silk mill be metered according to whether it was used for light or power and paid for at the city rates. Power is furnished at 220 volts at a cost per kilowatt-hour of 4 cents, and energy for lighting is furnished at 110 volts at a cost of 10 cents per kilowatt-hour. The silk mills purchased their energy at the power voltage and rates and then, by use of their own transformers, used some of it for lighting purposes. The court held that the city was justified in requiring them to meter both services and pay for them according to the established rates, chiefly because the cost of maintaining the plant for lighting purposes, the use of which was largely confined to certain hours of the day, made necessary an additional charge for lighting service. (128 At. 656.)

Civic Authorities Liable for Damages When Accident Results from Poor Street Lighting.—Under their duty to keep the streets in a safe condition, civic authorities are chargeable with seeing that they are properly lighted, for unsafe conditions may result from improper lighting as well as from a defect in the street. So holding, the Court of Appeals of the District of Columbia has affirmed a judgment of $4,500 against the District in favor of Joseph A. Berberich, whose automobile was demolished when it collided with an upright supporting a viaduct. In its decision the court said: "The degree of lighting required will depend upon existing conditions. In the present case, as clouds and mist settled in wet or damp weather about the viaduct, the District was charged with the duty of meeting this emergency by proper and sufficient lighting facilities. The lights are for protection on cloudy and dark nights as well as moonlight nights. In other words, lights are for night protection and should be of sufficient strength and in such position as to meet every ordinary requirement. The jury, therefore, was not required to pass on the number and character of the lights, but from the evidence whether the lighting at the time of the accident was sufficient to make the place reasonably safe. The evidence was sufficient to support the verdict."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

New Electric Power Club Standards

Policy of the Association Discussed by President Timmerman—Standards Amplified by Operating and Installation Instructions—Details of New Standards Announced

ONE of the constructive accomplishments of the Electric Power Club has been the making of standards for electric power apparatus. At the club's recent meeting at Hot Springs, Va., briefly reported in the ELECTRICAL WORLD for May 30, several new steps were taken in its standardization program. The power switchboard and switching equipment section proposed a new handbook covering this equipment, and the book was accepted by the board of governors. It includes instructions for the installation, operation and care of power switchboards, oil circuit breakers and power-switching equipment. In addition, standard definitions of relays, switches and switchboard equipment, graphic symbols and abbreviations which have been revised and brought up to date are included. Part III of the handbook contains the standards for power switchboard and switching equipment and Part IV the electrical safety conference standards. The instructions for the installation, operation and care of power switchboards are of a character to enable those using this equipment to install it properly and care for it under service conditions. The instructions cover the use of the structures for the switchboards, the main connections, the secondary and small wiring, the ground connection and the operation and repair of switchboards. Similar things are covered for oil breakers, including the mounting of the different types, handling the oil, testing, and the connection and the auxiliaries of the oil breakers.

The standard connections and marking of terminals produced by the Electric Power Club have been adopted as an American engineering standard with the Electric Power Club as sponsor and have now been published in standard form. The instructions for the care and operation of transformers have been revised where they apply to power transformers, and a new subdivision covering instructions for the care and operation of distribution transformers has been inserted. The handbook publications now available include instructions for the care and operation of transformers, motors and generators, and power switchboards and switchboard equipment, covering roughly the field of operations suggested by the titles. At the meeting of the board it was approved as recommended practice that the standard length of high-voltage leads outside the transformer tank shall be 24 in. and the standard length of low-voltage leads outside the tank shall be 15 in. The exception is that where this length of 15 in. would extend below the bottom of the tank the length should be reduced so as to reach approximately the bottom of the tank.

POLICY OF CLUB IN THE PAST

In his presidential address, A. H. Timmerman covered quite thoroughly the policy and history of the Power Club with regard to standards. He pointed out that the early activities in commercial standardization resulted in apparent conflict between the Electric Power Club and other organizations, and in order to clear up the situation the board of governors of the Electric Power Club adopted resolutions on May 3, 1916, covering its work in the standardization field and relations with other organizations. This resolution of the board sets forth clearly as a fundamental thought that in all standardization work upon which manufacturers' guarantees are based the manufacturers of electrical apparatus are vitally interested, and that while other organizations may adopt standards which represent safe limits of operation, such organizations must not attempt to force upon the Electric Power Club and the manufacturers such standards as in the belief of the manufacturers do not represent safe commercial practices. It may be the function of the A. I. E. E. to say what are considered temperatures at which various classes of insulation may be operated safely, but if in the judgment of the manufacturer such a limit is too high to use in ordinary commercial practice, the manufacturer must be the one to decide the maximum temperature at which he considers it safe to operate ordinary commercial apparatus. The responsibility for the quality of the apparatus rests upon the shoulder of the manufacturer only, and he pays the bill if the apparatus does not have a satisfactory life. This is a responsibility which cannot be passed along to any other organization.

MANUFACTURER MUST DETERMINE SAFETY

Along these lines President Timmerman said:

"It is perfectly proper for an engineering organization to specify the safe figures for tensile strength of certain steels, but it is up to the bridge designer and builder to determine the safe limit at which that steel should be used in the building of a bridge. If the bridge fails while supporting the ordinary load for which it was built, it is the manufacturer who pays the bill, whether or not some other organization asserted that it was safe to use the steel under the specified stresses.

"When a manufacturer thinks that certain practices are unsafe, he should not be forced by any organization to build such apparatus, nor should any organization attempt to coerce the manufacturer into building apparatus inferior in standard of quality to that which the manufacturer deems practicable. It is perfectly proper, on the other hand, if a manufacturer is building apparatus of inferior quality, that organizations engaged in the same line of endeavor should attempt to have that quality raised—but certainly never lowered.

"The board of governors of the Power Club, through committees co-operating either directly or through the Electrical Manufacturers' Council with other organizations, is attempting to reach an understanding with these organizations on many questions of vital importance to the industry. In this standardization work with other organizations the board has recognized the following guiding principles:

"'1. When the intent and purpose of a rule or standard of another organization is adopted by the Electric Power Club, suitable credit should be given in publication, even if the exact wording has not been adopted.

"'2. When other organizations co-operate either formally or informally with the Electric Power Club in the development of any group of rules, credit for the co-operation and assistance should be indicated in a suitable manner in publication of the rules in question.

"'3. When it is intended that such co-operation shall constitute a preliminary step in the development of an American standard, this intent should be suitably indicated in publications of the rules in question.'

"The Electric Power Club has been engaged through the American Engineering Standards Committee in much valuable standardization work of national importance. While the method of procedure of the American Engineering Standards Committee was admirably worked out, there are naturally many questions arising which require amplification in the direction of greater definiteness. It is the writer's opinion that all standardization work of the A. E. S. C. should be finally published as American standards, which give therein the name of the sponsor and other co-operating bodies. They should not be published as standards of the sponsor, approved by the A. E. S. C. In other words, if we are attempting to build up a set of American standards, let us be sure that they are put out as American standards, not as standards of some individual organization approved by the A. E. S. C. This matter of standardization is of such vital importance that we cannot afford to have anything detract from the value of real American standards, and the Electric Power Club through its board of

governors stands squarely on the above basis. The Electric Power Club has recently published an American engineering standard on 'Standard Connections and Marking of Terminals —Electric Power Apparatus.' This standard was recently approved by the American Engineering Standards Committee and is now published by the Electric Power Club as sponsor.

LITTLE STANDARDIZATION OF COMMERCIAL PRACTICES

"We have spent the past sixteen or seventeen years in standardization work which has been of very great value to the industry from a technical standardization standpoint. From the standpoint of standardization of commercial practices we have, however, done little, and we view the present commercial situation in the electrical apparatus industry as being far from satisfactory from a commercial standpoint. It is of the utmost importance, not only to the electrical manufacturing industry, but also to the buying public and the general industrial development of the country as a whole, that the electrical manufacturing industry, as well as many others, be placed upon a sound financial basis. With hourly rates of labor at practically double their pre-war figures and many items of material still very much in excess of pre-war costs, we find fractional-horsepower, single-phase motors selling at from 10 to 40 per cent less than they were in 1914. While selling prices of polyphase motors have not declined as drastically as this, they still show the same general trend.

"Standardization has aided the electrical manufacturing industry of this country in the direction of reduction of costs, and this reduction in costs has been immediately passed on to the buying public, with no apparent gain to the industry itself except as may accrue through increased volume and resultant reduction of cost. Standardization is having a far-reaching effect which was not contemplated at the time of its inauguration and has resulted in a more or less general leveling of electrical apparatus characteristics. There is an effort on the part of certain elements of the buying public to standardize still further in the direction of mechanical dimensions of electrical apparatus, thereby producing a still further leveling operation which may eventually result, if carried to the extreme, in the elimination of all special qualities and characteristics.

CAN STANDARDIZATION GO TOO FAR?

"This brings us face to face with the question, Can standardization be carried too far? In my mind, the answer is unquestionably, Yes. If standardization is carried to the extent where it stops progress in the art, it is certainly harmful. If it is carried to the extent of putting all apparatus on the same level, there would remain only one further element of standardization, and that is standardization of price. I do not mean to suggest that this standardization would be through co-operation or agreement among manufacturers, but with the present excessive manufacturing capacity in this country the selling price will naturally come to the same level if there is no difference in the apparatus, or the smaller and less well-known organization will perish. In other words with standardization carried to the ultimate, it becomes a question of survival of the fittest, and by the fittest I do not mean necessarily that manufacturing organization which is best able to produce the apparatus in question or that organization which puts most thought and effort into the reduction of cost, but on the other hand, I do mean that organization which through its diversity of lines of manufacture is enabled to sell certain lines of product at abnormally low figures, owing to the fact that it can well carry on business through other lines of manufacture in which there is little or no competition and in which profits under such conditions are greater.

"This situation is one which needs our most serious consideration, because, after all, the Electric Power Club will have failed as an industrial association if it cannot through its efforts put the individual units of that industry on a basis which will enable them not only to live but to expand.

"There is no question in the writer's mind that standardization in the long run is beneficial, not only to the industry, but to the general development of the country as a whole, in that it increases the productivity of the individual and results in the betterment of living conditions of all elements of our population. It may be necessary, however, in view of the far-reaching effects of standardization, above referred to, that a further development of the national standardization program must be followed by such industrial legislation as will reduce the effects of the present very serious competitive situation."

Comments on Trade Association Decisions

Neagle, Montague and Hoover Discuss the Decisions and Show How They Clear the Way for Gathering Statistics— Department of Justice Welcomes Clarification

THE whole pall of uncertainty which for years has enshrouded trade association activities was unexpectedly swept aside last week when the Supreme Court of the United States handed down its rulings in the cases of the Maple Flooring Manufacturers' Association and the Cement Manufacturers' Protective Association. The broad principles set forth in these decisions were chronicled in the June 6 issue of the ELECTRICAL WORLD. Comments on these far-reaching decisions are now presented.

Francis E. Neagle, counsel for the Electrical Manufacturers' Council, the Associated Manufacturers of Electrical Supplies, the Electric Power Club and the Electric Hoist Manufacturers' Association, when asked to comment upon the decisions of the Supreme Court in these cases, said:

"These decisions clearly evidence a better understanding of the value, utility and necessity of trade associations than existed when the Sherman act was passed in 1890 and when the hardwood lumber and linseed cases were decided in 1921 and 1923 respectively, but they do not indicate that trade associations hereafter are to have a free hand. For this much credit must be given to Secretary Hoover and his aids.

"The Supreme Court distinguished the hardwood lumber case and the linseed case, in which statistical activities were involved, upon the ground that in those cases the character of the information gathered and the use which was made of it 'led irresistibly to the conclusion that they had resulted, or would necessarily result, in a concerted effort of the defendants to curtail production or raise prices of commodities shipped in interstate commerce.' The unlawfulness of the combination arose not from the fact that the defendants had effected a combination to gather and disseminate information, but from the fact that the court inferred from the peculiar circumstances of each case that concerted action had resulted or would necessarily result in tending arbitrarily to lessen production or increase prices.

"In the cement and maple flooring cases the Supreme Court held that there was no proof of agreement or concert of action to raise prices or lessen production, and that in the absence of such proof under the present plan of operations of the defendants there existed no basis in the mere gathering and dissemination of statistical information or in the activities of the associations for the inference that concerted action would of necessity result from the mere availability of the information. The court recognized that economic results of the gathering and distribution of information with regard to production and distribution, cost and prices of actual sales result in the stabilization of an industry, the production of fair price levels and the avoidance of that waste which inevitably attends the unintelligent conduct of economic enterprises, and that 'restraint upon free competition begins when improper use is made of that information through any concerted action which operates to restrain the freedom of action of those who buy and sell.'

STATISTICAL ACTIVITIES DEFINED

"The government and other agencies collect statistics with regard to cotton, grain, petroleum, etc., and it is now clear that similar statistics can be gathered and disseminated by members of trade associations and that they do not thereby become conspirators under the Sherman law. The court is careful to point out, however, that each case arising under the Sherman act must be determined upon the particular facts disclosed by the record and expressly limits its decisions so that they hold that 'trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their product, the volume of production, the actual price which the product has brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principal point of

shipment to the points of consumption,' and which 'meet and discuss such information and statistics without, however, reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce.'

Decisions Constitute a Landmark

"The decisions of the Supreme Court in these two cases constitute a landmark in the history of trade associations and should go a long way toward assuring business men of the real value accruing to them from membership in such associations. The twilight zone in which trade associations have had to function has now, so far as statistical activities are concerned, become more of a daylight zone. The Supreme Court has clearly defined the scope of their statistical activities and they should be able to proceed along beneficial lines with some assurance that they will not run afoul of the law.

"The Supreme Court does not consider, as trade association members do not consider, that the mere existence of a trade association and its every activity are part of a scheme or device to restrict or eliminate normal healthy competition. Statistical activities constitute a wide field which trade associations have heretofore been chary of occupying. The recent decisions, however, will enable industry, and particularly the electrical industry, to have made available through trade associations statistics that will enable individual manufacturers to prevent overproduction, to avoid waste, to learn what real cost finding is (because some now know it and others must), and to avoid business crises resulting from overproduction and its consequence. The Supreme Court has given a helping hand to industry."

Gilbert H. Montague, an attorney versed in trade association affairs, in commenting on these decisions, said: They are of the first magnitude in their importance to trade associations and the business community generally. Inevitably, the highly practical question arises how and in what respects the Supreme Court, in upholding the exchange of statistical information in these cases, has differentiated between them and the hardwood case and the linseed case, in which the Supreme Court, by an emphatic majority, reached a contrary determination several years ago. The Supreme Court, in each of these recent decisions, reversed judgments of the lower federal courts which, according to the courts rendering those judgments, seemed compelled by the Supreme Court's earlier decisions in the hardwood case and the linseed case. To a considerable degree, therefore, it seems certain that many inferences and implications which the lower federal courts, and the Department of Justice, and the Federal Trade Commission, and cautious lawyers everywhere, have heretofore been ascribing to the earlier Supreme Court decisions in the hardwood case and the linseed case have at last been decisively rejected by the Supreme Court, in the interest of a larger freedom for trade associations in exchanging statistical information necessary or useful in the conduct of business. A great quickening and an enormous extension of the exchange of statistical information through trade associations may now be expected throughout the country.

"Secretary Hoover's four years' fight for the right of trade associations to collect and disseminate statistical information appears finally to be victoriously ended by these recent Supreme Court decisions. For his zeal in asserting the economic justification of these activities against the contrary contention of the Department of Justice Mr. Hoover deserves the congratulations of the entire business world."

Secretary Hoover, when informed of the Supreme Court decisions, said: "I am advised that the recent Supreme Court decision in the trade association cases clarifies one large point; that is, that the reporting of volume of production, stocks, consumption and the movement of prices for both farmers and business men is in the interest of competition and sound organization. I am advised that it is equally clear from the decision that any conspiracy to fix prices or to control distribution is as much a violation of the law as ever. Our understanding of the distinction is that while brickbats can be used to commit murder, it is not necessary to prohibit the construction of brick houses in order to prevent it. Anybody about to enter into a conspiracy in restraint of trade naturally uses figures and statistics, but this does not imply that much statistics are responsible for such conspiracies."

A Clear Definition

At the Department of Justice it was stated that the clarification is welcomed. The action of the Supreme Court will interfere with no pending prosecution, it was declared. The department intends to keep trade association activities under a certain amount of surveillance. It was pointed out that the decisions in no way weaken the prohibitions of the anti-trust laws against any agreement or conspiracy to control prices. In addition the Attorney-General authorized the following statement:

"These decisions make it plain that the mere collection and dissemination by a trade association of statistics relating to prices on past transactions, production, stocks on hand and sales is not in and of itself illegal. Both the Cement and Maple Flooring associations maintained an elaborate system of gathering and distributing such statistics. The court plainly decided these cases against the government upon the ground that the records did not disclose any or sufficient evidence of an agreement between the members to make use of the statistics in fixing prices, curtailing production or otherwise restraining trade.

"The court did not overrule but expressly distinguished the former decisions in the hardwood lumber and linseed oil cases, so that the Sherman law remains effective as to the associations which may use a statistical service as a means of facilitating the fixing of prices, etc., by agreement. The Department of Justice will continue to be alert to detect and prosecute associations whose operations go beyond the mere dissemination of knowledge, now sanctioned by the Supreme Court, and actually result in combinations, conspiracies and agreements in restraint of trade in violation of the law. Trade associations now have a clear definition of the law and can govern themselves accordingly within the limits of the decision and not operate in agreement to the detriment of the public and in violation of the law."

Business Conditions

STEADY buying of electrical equipment and supplies continues, with some increase in bookings noted this month. There is less activity in the demand for substation and generating equipment than existed three months previously, this being particularly true of equipment for steam-power plants. Inquiries for hydro-electric generating equipment and auxiliary apparatus are still quite active, especially in the Western territory. A producer of wooden poles reports that the demand is less than at the same time last year, but he is confident of increased sales by the end of the summer. Smaller poles for distribution work are selling better than those for transmission-line use. Steel mills have been active in purchasing electrical equipment.

The United States Steel Corporation has reported a reduction of 396,768 tons in forward business. Shipments are said to have been maintained on the same scale as in April, and new business booked in June is considered fair. Unfilled orders on May 31, 4,049,800 tons, are the smallest total for any month since last November, when trade began to show a revival.

In New England central-station supplies and equipment are moving in good volume, with the sales of transformers and meters well above the quota for the month to date. Buying is in steady volume in the New York district. The demand for motors is good in that territory, and sales of electrical supplies and construction materials are very active. In the Southeast orders placed by power companies for construction materials continue steady. There is no break in sight of the very long drought and some alarm is felt regarding the damage that will result to crops. Most of the Southeastern power companies are already operating steam stations because of water scarcity, but there is no immediate danger of a power shortage. Business is spotty in the Middle West with a prevailing tendency toward monthly purchasing on a hand-to-mouth basis. The purchasing of construction materials by central-station companies in that district is active. On the Pacific Coast there is a good demand for building construction material.

Stable Business Conditions Forecast by E. M. Herr

AT THE annual meeting of stockholders held on Wednesday in the main works of the Westinghouse Electric & Manufacturing Company, President E. M. Herr forecast a stable volume of business for the ensuing year. Mr. Herr said: "The volume of business continues on a satisfactory basis and without material variation either up or down. The outlook for the year is for a rather stable condition in the volume of business taken and consequently of shipments of our product." The sole change in the directorate was the election of F. A. Merrick, vice-president and general manager of the Westinghouse company, to the place made vacant by the recent death of A. G. Becker. His term expires in 1926. The other directors whose terms expired were re-elected.

Non-Ferrous Metal Market Quiet —Prices Vary Only Slightly

NONE of the non-ferrous metals have been in active demand. Prices were generally steady, however, and tin is even higher than last week despite the small volume of business. Copper and lead are slightly lower, and zinc is back to the level of a week ago after again going above 7 cents (St. Louis) during the week owing to export demand. The copper market has declined somewhat from the 13⅝ cents delivered level of a week or so ago. Several producers are still holding at that figure, but admit that the quotation is only nominal and that good tonnages have been available at 13½ cents. The total volume of sales for the week has about equaled the rate of the last two or three weeks. The decline has been caused by lower offerings abroad.

The contract price for lead set by the American Smelting & Refining Company continues at 8.40 cents, New York. Other sellers were able to get more than this, but in the last two days lead has been so freely offered for any shipment, from spot to July, at the 8.40-cent quotation that premium prices have become only nominal or where special brands are desired. Inquiries and sales have been in much more moderate volume, the stampede for lead having entirely vanished. Most buyers want June shipment, there being so far little demand for July. The price of zinc again went above 7 cents last week (Thursday), owing to advances in the foreign market, though it has again broken through that level in the last two days. Domestic consumers have been almost entirely out of the market, especially galvanizers, though a few round lots of brass special have been sold at ten to fifteen points premium over Prime Western. The strength in tin continues to be inspired by London, where pool buying is said to have supported the market. Buyers here have been scarce, and often the metal has been offered below import cost.

NEW YORK METAL MARKET PRICES

	June 3, 1925 Cents per Pound	June 10, 1925 Cents per Pound
Copper, electrolytic	13.60	13½
Lead, Am. S. & R. price	8.40	8.40
Antimony	16½	16½
Nickel, ingot	31	31
Zinc, spot	7.30-7.35	7.32½-7.35
Tin, Straits	54½	55½
Aluminum, 98 to 99 per cent	28	28

Base copper price June 10, 1925, 16 cents.

Equipment Moving in Good Volume in New England

CENTRAL-STATION supplies and equipment are moving well in New England with the volume of sales of transformers and meters well above the quota for the month to date. One jobber reports the sale of three carloads of line hardware during the week and a normal trend amounting to about six cars per week of poles, cross-arms and wire. The Westinghouse Electric & Manufacturing Company has been awarded the contract, amounting to about $50,000, for equipment consisting of transformers and regulating apparatus for a new substation of the Worcester Electric Light Company.

The heat wave throughout New England during the past week culminated in an unusual flurry of sales of fans and refrigerating units. One manufacturer reports the sale of more than 5,500 fans, the oscillating type being in strong demand. It is estimated that most dealers sold out the normal season's supply during the hot wave.

Buying in Steady Volume in the New York District

BUYING of material by central-station companies in the New York district is considered fairly active as a whole with some companies especially prominent. One company has recently placed an order for twelve 5-ton electric trucks. Another company in upper New York State has been actively purchasing varied material for extensions and improvements. The demand for motors has been rather good, with competition very keen, and a number of sales of motors for pumping equipment have been made.

Sales of fans have been very good and some manufacturers' stocks have been depleted. Present orders are being quoted on a four to five weeks' delivery basis. Jobbers report an increasing volume of business at low profit. Sales of electrical supplies and construction materials are very active.

Power Companies Buying Steadily in the Southeast

PURCHASES of construction materials by the larger power companies in the Southeast continue steady, and good orders are being received from the small privately owned electric plants, but orders from municipal plants are slow. There has been a considerable lull lately in the demand for lighting fixtures and glassware, but sales of lamps are excellent. The summer season has considerably stimulated the sales of flashlights. Little or no change is reported in industrial lines and conditions generally are somewhat quiet.

There is no break in sight to the very long drought in the Southeast, and some alarm is felt regarding the damage that will result to crops throughout the section unless there is rain within the immediate future. Most of the Southeastern power companies are already operating steam stations because of water shortage, and while there is no immediate likelihood of a power shortage, rains are very necessary for storage preparatory to handling fall loads. The present uncertain crop condition has served to slow up electrical retail business in the small centers dependent upon favorable agricultural conditions for their prosperity, but the hot weather caused a brisk movement of fans, and jobbers report the sales volume to date in excess of this time last year. Sales of small socket appliances are reported as quiet, but ranges, washing machines and electric churns are all showing a marked increase in demand for the year to date. Washing-machine business shows a very heavy increase, though the volume of sales remains small, as until a few months ago practically no sales were made.

Business Spotty in Middle West— Construction Work Active

BUSINESS appears to be somewhat spotty in the Middle West, with large purchases the exception rather than the rule. The prevailing tendency appears to be toward monthly purchasing on a hand-to-mouth basis, but confidence is expressed throughout the entire territory by various manufacturers. Equipment purchasing by the utility companies continues to a lesser degree, but the purchasing of construction materials remains quite active. There is a good demand for distribution transformers, direct-current watt-hour meters and pole-line hardware. Among the interesting orders placed this week was one for fifteen 225-hp., 2,300-volt motors to be used in the Chicago district.

Jobbers report satisfactory sales, with the volume of business somewhat better than last week. The extremely torrid weather has increased fan sales materially, one jobber stating that his sales over a two-day period were better than $30,000. Socket appliance sales have shown a considerable increase.

Good Demand for Building Material on the Pacific Coast

SCHEDULE material, motors in pumping-plant sizes and conduit are in good demand on the Pacific Coast. Rubber-covered wire and standard porcelains were also moving well, largely owing to a price flurry. Sales of radiators have been stimulated by a special 5 per cent discount, and heavy-duty sizes are selling well. Ranges are also in good demand.

Power company buying has been light. Recent inquiries for quotations have covered one carload of 2½-in. fiber conduit and one carload of deep-groove double-petticoat glass insulators. Industrial business has been good. Contracts have been awarded by the Board of Public Works, Seattle, for furnishing the municipal lighting department with sixty floodlights, 10,000 porcelain insulators and 50 tons of weatherproof wire and for installing a street-lighting system.

Activities of the Trade

Edison Lamp Works to Hold Three Sales Conferences

The Edison Lamp Works of the General Electric Company will hold three summer sales conferences this year at its new Lighting Institute at Harrison, N. J. The first, the junior sales conference, will be held from July 20-25; the second, for women engaged in the electrical business, from July 27-31, and the third, the senior sales conference, will be held August 3-8.

The junior sales conference is primarily for men who have had little experience in the lighting field. The senior sales conference is essentially an illumination design course and is intended primarily for lighting salesmen. In addition to covering the subject of illuminating engineering, lectures will be given on commercial engineering, agency service, sales policies, accounting and advertising. The women's conference will be a course of instruction in home lighting and in the merchandising of lamps. Those desiring to attend should send notification as early as possible to R. E. Harrington, Edison Lamp Works of General Electric Company, Harrison, N. J.

Bodine Electric Celebrates Its Twentieth Year of Service

The Bodine Electric Company, Ohio Street and Oakley Boulevard, Chicago, manufacturer of fractional-horsepower motors, motor-generators and other apparatus, celebrated last month its twentieth year of service. The celebration took the form of a banquet given by the directors to the entire personnel of the company at the Morrison Hotel, Chicago. Paul J. Bodine outlined the history and progress of the company from a small shop employing only three mechanics to the present large organization housed in a modern two-story brick building. E. W. Larson, A. G. Anderson, Joseph Record, V. C. Partz and P. P. Dominikowski, department heads and long-time members of the organization, participated in the speech making.

General Electric Company Receives Large Orders

The Colorado Fuel & Iron Company has recently placed a contract with the General Electric Company for complete electrical equipment for its Minnequa Works at Pueblo, Col. This plant, the largest steel mill in the West, was formerly steam-engine-driven. The old plant will be superseded by a complete new power house using powdered-fuel and waste-gas-fired boilers, which will provide steam at 300 lb. pressure and 180 deg. F. superheat.

Two 10,000-kw. turbo-generators will be the prime movers and will furnish alternating current to the main power lines at 6,600 volts. Other power-house equipment will be supplied, as well as complete electrical equipment for driving a rod mill, a 10-in. merchant mill, a 14-in. merchant mill and a rail mill.

A 77,000-kw. unit to be added to the Crawford Avenue generating station of the Commonwealth Edison Company, Chicago, will also be built by the General Electric Company, which supplied the 60,000-kw. unit in operation since last year. It will be a cross-compound unit, consisting of a 28,250-kw., 85 per cent power-factor generator and a 2,000-kw., 2,300-volt, 60-cycle service generator in the high-pressure element and a 46,750-kw., 85 per cent power-factor generator and direct-connected exciter in the low-pressure element.

The high-pressure unit will operate at 1,800 r.p.m. and will take steam at 550 lb. gage and 750 deg. F. total temperature. It will exhaust at 95 lb. gage to the low-pressure element, which will operate at 1,200 r.p.m. As in the case of the previously installed turbine, twin vertical condensers will be used.

Bates Company Gets Large Order for Steel Poles

The Bates Expanded Steel Truss Company, Chicago, reports the recent sale and immediate shipment of Bates expanded steel poles for a 43-mile, 66,000-volt transmission line now in course of construction in Vermont. The company also states that its volume of May business was somewhat below that of April, but sales during the first five months of 1925 are ahead of the same period in 1924.

Commercial Truck Gets Large Central-Station Order

An order has just been placed by the Public Service Electric & Gas Company, Newark, N. J., for twelve 5-ton electric trucks, at a cost of approximately $90,000, with the Commercial Truck Company, 300 Hunting Park Avenue, Philadelphia. The trucks are to be of four-wheel drive construction and are to be each equipped with a winch mechanism for handling poles for transmission-line work and for pulling cable. The advantage of a steady, even pull when using the electric truck in installing cable was one of the factors influencing the purchase of electric trucks for this work.

These trucks will be equipped with an "Exide Ironclad" battery of forty-eight cells, each having twenty-seven plates. Four of these trucks will be sent to the Public Service southern division headquarters in Trenton, N. J., four to the central division headquarters in Elizabeth, N. J., and four to the Hudson division in Paterson, N. J.

Westinghouse Gets Order for Large Self-Cooled Transformers

The Electric Illuminating Company of Boston has purchased from the Westinghouse Electric & Manufacturing Company for its Weymouth plant two 25,000-kva., three-phase, self-cooled, 60-cycle transformers, stepping up from 14,000 volts to 120,000 volts. These will be the largest self- cooled transformers ever built. This investment in equipment is part of the Boston company's order for over $500 000 worth of equipment, awarded to Westinghouse, to be used for a tie-in between the Weymouth plant and the Montaup Electric Company at Fall River. Eventually the tie will connect with the New England Power Company at Millbury and Davis Bridge.

In this new installation are also included nineteen 132-kv., 400-amp., single-throw electrically operated oil circuit breakers complete with electric mechanism mechanically trip-free in all positions, as well as other transformers. All of the transformers are so designed that auxiliary apparatus can be applied later to make them suitable for tap changing under load.

General Electric Company to Work Pirelli Cable Patents

The General Electric Company has concluded an agreement with the Società Italiana Pirelli of Milan, Italy, for working the Pirelli patents on paper-insulated cables, joints and fittings, together with the use of manufacturing and research information in regard to this type of cable, in the United States. This agreement will render available to the electric public utilities of the United States the Pirelli company's special development in high-tension cable and the General Electric Company's experience in manufacture, engineering and research in the application of such high-tension cables to American practice.

The Terry Steam Turbine Company, Hartford, Conn., announces that it has appointed C. F. Henderson, Call Building, San Francisco, as sales representative for that district.

The Maytag Company, Newton, Iowa, manufacturer of washing machines, is having plans prepared for a six-story addition, 85 ft. x 213 ft., to cost $150,000 with new machinery and equipment.

The Westinghouse Electric & Manufacturing Company has plans for the erection of an eleven-story building at its plants at East Pittsburgh to be used for offices.

Edward T. Moore, 500 Cahill Building, Syracuse, N. Y., manufacturer of the Moore electric power regulator, has received an order from the Reading Steel Casting Company, Reading, Pa., to design and construct an electric steel melting furnace of the three-phase, three-electrode type with a capacity of from 10 tons to 15 tons. The company has also received recent orders for the "Edmoore demand limitator" from the Universal Steel Company, Bridgeville, Pa.; the Reading Steel Casting Company, Reading, Pa., and the American Rolling Mills Company, Zanesville, Ohio.

The Stephens-Adamson Manufacturing Company, manufacturer of conveying, transmission and screening machinery and belt conveyors, announces the opening of a sales engineering office at 621 Wells Fargo Express Building, San Francisco, under the management of Charles E. Bruff, formerly of the

mining engineering firm of Bradley, Bruff & LaBarthe.

The Portland Electric Power Company, Portland, Ore., has been awarded the contract for ornamental post lighting of the newly created lighting district embracing seventeen blocks on Broadway between Hoyt and Jefferson Streets, Portland, for $118,876. The unit adopted was a union-metal, pressed-steel standard, with two General Electric "Novalux" units with medium alabaster rippled globe and canopy.

New Equipment Available

Arc Welder

An arc-welding generator that needs no external stabilizing devices to assist the operator to strike and maintain the arc has been placed on the market by the Northwestern Manufacturing Company, Milwaukee. This motor-generator set, known as the "Hansen" arc welder, utilizes a special disposition of the commutating-pole winding to obtain stabilization of the arc.

Two ratings of "ansen" welders are now available. One has a current range of 60 amp. to 350 amp., is driven by a 10-hp. motor and is good for a continuous welding duty of 225 amp. to 250 amp. The larger machine has a range of current from 90 amp. to 400 amp. and is intended for both metallic and carbon electrodes. This machine is driven by a 15-hp. motor. One application of the "Hansen" arc welder has been the development of a process of welding the ends of the bars of squirrel-cage motors together to form end rings.

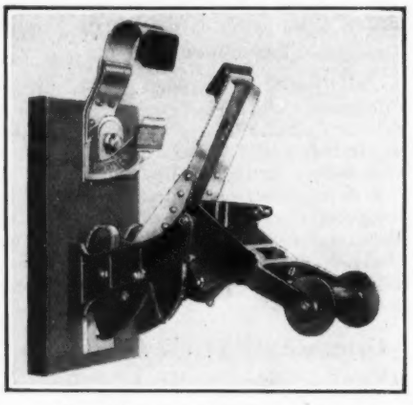
Double Polyphase Meter

A double polyphase switchboard-type watt-hour meter, originally designed to enable a central-station company to measure the interchange of power in a transmission circuit where the available switchboard space was limited, has been placed on the market by the Sangamo Electric Company, Springfield, Ill. The meter consists of two vertical polyphase meters on a single base and is readily adaptable to such additional fundamental uses as the measurement of power in separate circuits or the determination of the energy and reactive components in a single circuit. Each polyphase element may be fitted with a standard register for measurement of energy in separate circuits, and, if desired, the registers may be equipped with detents, thus obtaining measurement in and out on interchange of power.

For purposes of load analysis one of the polyphase elements can be internally connected to measure the reactive component. In any of these arrangements the Sangamo type "HMP" demand attachment can be substituted for the standard register, thus indicating the maximum demand in the separate or combined circuits or the energy and reactive component demands in the same circuits. The polyphase elements are so mounted that a single differential register of the type used on Sangamo horizontal polyphase meters may be installed. This permits the summation of energy in two separate circuits on a single register. When separate circuits are being metered by the polyphase elements, they need not be of the same rating in voltage, current or frequency.

Circuit Breaker

A line of non-closable-on-overload (free-handle) circuit breakers have been placed on the market by the Roller-Smith Company, 233 Broadway, New York. This feature can now be supplied with any circuit breaker manufactured by the company and, as shown in the illustration, does not add any complications. The new "R-S" free-handle circuit breaker differs from the regular plain overload breaker mainly in the construction of the handle lever plus the addition of a tripping lever actuated by the regular overload armature.



FREE-HANDLE CIRCUIT BREAKER

Throw-Over Switch

A new throw-over switch, which has been given the designation CR-7896-M1, is now being marketed by the General Electric Company for use in automatically transferring lighting circuits to an emergency source, as in theaters, etc., where an emergency lighting system for exit lights is required for use when the normal lighting supply fails. In designing the switch exceptionally wide gaps were arranged between the contact tips, thus preventing the arc from holding over and throwing the two sources of current together.

The new switch has a tip capacity of 30 amp. and may be used on circuits as high as 440 volts. It is mounted on a compound base and inclosed in a sheet metal case for wall mounting. The approximate over-all dimensions of the inclosing case are 14 in. high, 8½ in. wide and 7½ in. deep. Knockouts are provided at the top and bottom for conduit wiring.

Fire-Pump Controllers

The complete line of fire-pump controllers made by the Cutler-Hammer Manufacturing Company, Milwaukee, has been redesigned to meet the latest requirements of the National Board of Fire Underwriters. The controllers include both manually and automatically operated types for direct-current and alternating-current service as well as types arranged for combined manual and automatic control. The combined manual and automatic starter for direct-current motor-driven fire pumps has the same features as the manual starter, which are a double-pole circuit breaker with each pole closed independently, a pilot light to indicate when power is on the line and carbon-to-copper current-carrying contacts as used on Cutler-Hammer elevator controllers. For automatic operation the time of acceleration is controlled by an air dashpot. A pressure governor controls the operation of the accelerating device.

The manual starters for alternating-current motor-driven pumps are made with open or inclosed panels and in two types, the auto-transformer or compensator type and secondary resistor type.

Combined manual and automatic starters for alternating-current motor-driven pumps are made in the primary resistor type for squirrel-cage motors and the secondary-resistor type for slip-ring motors. For automatic operation the time of acceleration is controlled by an air dashpot. A pressure governor controls the operation of the accelerating device, and a magnetic main contactor is interlocked with the accelerating movement so that it closes before the resistor is out of circuit.

Speed-Reduction Unit

A speed-reduction unit utilizing a Hele-Shaw hydraulic pump and Hele-Shaw hydraulic motor in place of the usual nest of gears has been placed on the market by the American Engineering Company, Philadelphia. By utilizing hydraulic pressure it is said that great power and silent, smooth operation are combined with extreme flexibility of control. Elimination of gears, with their attendant friction losses, is also said to give high mechanical efficiency. Any desired ratio of speed reduction, up to 850 to 1, can be had without stopping the direct-connected electric motor. This device has already been adapted to a wide variety of machine drives, including presses, broaching machines, planers, testing machines, cranes and mechanical stokers, and has many uses on shipboard for deck machinery.

Coil Spreader.—Several improvements have been added to the "Segur" armature coil spreader placed on the market by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia. Improvements have been made in the coil blocks, the end-supporting knuckles and in the accuracy with which the machine duplicates the angular relation of the slot portion of the coil. The machine embodies the latest ideas in coil-forming equipment, and the setting-up time is said to have been materially reduced.

New Trade Literature

CIRCUIT BREAKERS. — The Roller-Smith Company, 233 Broadway, New York City, is distributing a supplement to bulletin No. 530, covering its new types of non-closable-on-overload circuit breakers, free-handle type.

AUTOMATIC SWITCHING EQUIPMENT.—Bulletin No. 67,716A issued by the General Electric Company, Schenectady, N. Y., describes its automatic switching equipment for indoor alternating-current reclosing feeder service for 440 volts to 7,500 volts. It contains an illustration showing an installation of automatic switching equipment for five two-phase and two single-phase, 2,200-volt, 60-cycle reclosing feeders and automatic transfer apparatus for incoming lines, and also a drawing showing the operation of the device.

ANCHORS AND TAMPERING BAR.—The Everstick Anchor Company, St. Louis, has issued a folder describing its various types of Everstick anchors. The company is also distributing a leaflet calling attention to its improved tamping bar for spreading Everstick anchors.

ELECTRIC METERS AND DEMAND INDICATOR.—Landis & Gyr, Ltd., Zug, Switzerland, have issued bulletins Nos. TB-2,201, TB-2,211 and TB-2,303b, which describe and illustrate their electric meters (induction-type motor meters) for single-phase and polyphase circuits, the "Elgee" meter bearings and electric meters combined with the maximum-demand indicator respectively. L. H. Junod & Company, 104 Fifth Avenue, New York City, are sole agents for the United States.

DIESEL ENGINE. — Bulletin No. 808 issued by the Fulton Iron Works Company, St. Louis, covers its type "J" Fulton-Diesel engines, which are built in the larger sizes, ranging from 560 b.-hp. to 1,550 b.-hp., in which are incorporated special features, such as water-cooled exhaust valves and water-cooled pistons. It also contains a diagram of the engine and tabulated dimensions for the several sizes.

DIRECT-CURRENT SWITCHBOARD INSTRUMENTS.—Bulletin No. 400 issued by the Roller-Smith Company, 233 Broadway, New York City, covers all its small direct-current switchboard instruments except the "PV" type. Illustrations are given showing the various types of ammeters and voltmeters.

BAKELITE.—The Bakelite Corporation, 247 Park Avenue, New York City, is distributing a folder calling attention to the use of bakelite for potentiometer parts.

PERMEAMETER.—Frank P. Fahy, 16 East Forty-first Street, New York City, is distributing a leaflet calling attention to the "Simplex" permeameter for permeability and hysteresis testing.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Hamburg, Germany (No. 15,288), for agricultural machinery, particularly milking machines.

Purchase and agency is desired in Rio de Janeiro, Brazil (No. 15,246), for electrical goods.

An agency is desired in Nairobi, British East Africa (No. 15,206), for electric light plant equipment.

An agency is desired in Barcelona, Spain (No. 15,199), for radio frequency sets, tuned.

Purchase is desired in Johannesburg, South Africa (No. 15,241), of radio sets and parts.

Purchase and agency is desired in Windsor, Canada (No. 15,243), for radio sets and parts.

A sole agency is desired in Vienna, Austria (No. 15,245), for radio sets and parts.

Purchase and agency is desired in Arras, France (No. 15,247), for radio sets and parts.

Purchase and agency is desired in Budapest, Hungary (No. 15,244), for radio sets and parts and loud speakers of standard quality.

ASH CONVEYORS FOR WHITE BAY POWER HOUSE, AUSTRALIA.—Tenders will be received by the New South Wales Railways and Tramways Commissioners, Sydney, Australia, until Aug. 5 for two drag-link ash conveyors for the White Bay power house.

ELECTRIC CAPSTANS AND PORTABLE CRANE FOR NAPIER, NEW ZEALAND.—Tenders will be received by the Napier Harbor Board, Napier, New Zealand, until Aug. 10 for two electric capstans and twelve fairleads (Contract 270) and one portable crane, hand or electric (Contract 271).

POWER-PLANT EQUIPMENT WANTED IN SOUTH INDIA.—An engineering firm in South India, which has been granted a license to supply electricity under the Indian electricity act of 1910, according to the *Commerce Reports*, desires bids on equipment for three small plants, including Diesel engines, generators, switchboards and overhead-line material, to carry a total load not to exceed 450 kw. Specifications and blueprints are available at the New York and Chicago districts of the Bureau of Foreign and Domestic Commerce. An additional copy is available for loan by the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., and may be obtained by referring to No. 167,871.

PROPOSED NEW POWER PLANT FOR BUENOS AIRES, ARGENTINA. — The Spanish-Argentine Electricity Company (Cia Hispano-Argentino de Electricidad), *Commerce Reports* states, is planning to build a power station in the new port of Buenos Aires, to supply electricity for light and power in the city of Buenos Aires. The equipment will probably include seven steam turbo-generators, and coal-burning boilers will be used.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

FRANKLIN, N. H. — Plans are under consideration by the Sulloway Mills, Inc., for the installation of a hydro-electric plant to supply electricity for its local mill.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company plans to issue $175,000 in capital stock, the proceeds to be used for extension and improvements.

LOWELL, MASS.—The City Council is considering the installation of a new fire-alarm system, to cost about $150,000.

SPRINGFIELD, MASS.—The Massachusetts Mutual Life Insurance Company plans to build a power plant, to cost about $75,000, for use in connection with its proposed office and mechanical service building.

DERBY, CONN.—The Derby Gas & Electric Company contemplates extending its service to Huntington.

MANSFIELD, CONN.—The State Legislature has approved an appropriation of $25,000 for extensions and improvements in the power plant at the local State Training School.

Middle Atlantic States

BINGHAMTON, N. Y.—An ordinance has been introduced in the City Council providing for the installation of ornamental lamps on Main Street from the Court Street Bridge to Walnut Street, to be maintained by underground wires. The ordinance also provides that a contract be made with the Binghamton Light, Heat & Power Company to install and maintain the system.

BROOKLYN, N. Y.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for the installation of an electric lighting system in the officers' quarters, local naval hospital (Specification 4937).

BROOKLYN, N. Y. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 16 for rigging insulators, dry and flashlight batteries and searchlight mirrors, to be delivered at the Navy Supply Depot, South Brooklyn.

BROOKLYN, N. Y.—Bids will be received by the State Hospital Commission, Capitol, Albany, until June 24 for construction, sanitary and electric work, kitchen equipment and elevator additions and alterations to kitchen and dining-room building at the Brooklyn State Hospital, Creedmoor Division, Queens, Long Island.

BUFFALO, N. Y.—Plans filed by the Frontier Grain & Elevator Company for a proposed grain elevator, to cost about $225,000, include a power plant.

LITTLE VALLEY, N. Y.—The Village of Little Valley has petitioned the Public Service Commission for permission to extend the service of the municipal electric plant to furnish electricity to the town of Little Valley under a franchise granted by the Town Board.

MECHANICSVILLE, N. Y. — Plans are under way by the Adirondack Power & Light Corporation, Schenectady, for extensive improvements to its local power plant, including the construction of a new power station to supplant the present power house and to double the present capacity of the plant.

NEW YORK, N. Y.—The Associated Gas & Electric Company, 61 Broadway, New York City, has issued $14,000,000 in bonds, part of the proceeds to be used for new construction, particularly in connection with the property of the Staten Island Edison Corporation.

NEW YORK, N. Y.—Bids will be received by the Board of Estimate and Apportionment, Council Chamber, City Hall, until June 19, for furnishing and installing the elevator work in the New York County Court House, located on a site bounded by Centre, Worth, Baxter and Pearl Streets in the Borough of Manhattan.

RENSSELAER, N. Y.—Plans are under consideration by the Eastern New York Utilities Corporation for building an addition to its electric plant, at Stottville, to cost about $80,000.

SALEM, N. Y.—The Salem Light, Heat & Power Company has applied to the Public Service Commission for permission to extend its electric system in Salem, Hebron and Jackson.

SYRACUSE, N. Y.—The Syracuse Lighting Company, Inc., has applied for permission to purchase the municipal distributing system in De Ruyter and also for approval of the exercise of franchises in De Ruyter, Cuyler, Truxton, Phœnix, Volney and Schroeppel. If granted, the company proposes to extend its transmission and distribution system to serve the new territory, at a cost of about $48,700.

WINDHAM, N. Y.—The Windham Valley Electric Company has petitioned the Public Service Commission for permission to transfer its franchise and property to the New York State Gas & Electric Corporation, Ithaca. If granted, the latter proposes to extend its lines to connect with the Windham valley system, to enable the latter to serve a larger number of consumers.

CAMDEN, N. J.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 16, for motor-generators for the Camden and Fore River shipyards (Schedule 3840).

MARGATE CITY, N. J.—The Commissioners of Margate City have awarded contract for an ornamental lighting system and police and fire-alarm system. The contract, it is understood, does not include the installation of lamps on the "Boardwalk." Margate City has not a post office.

NEWARK, N. J.—The Pittsburgh Plate Glass Company, Frick Building, Pittsburgh, plans to install electric power equipment in its proposed local factory and distributing plant at the foot of Chester Avenue, to cost about $200,000.

PHILADELPHIA, PA. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 16, for one induction motor for the local shipyard (Schedule 3875).

PITTSBURGH, PA. — The Duquesne Light Company, Pittsburgh, has contracted to furnish electric light and power service in Ross Township and is planning transmission-line extensions.

SHARON, PA.—The Pennsylvania-Ohio Power & Light Company, Youngstown, Ohio, plans to erect a high-tension transmission line.

SMYRNA, DEL.—Bonds have been voted for $65,000, part of the fund to be used for extensions and improvements in the municipal street-lighting system.

SNOW HILL, MD.—The Worcester Electric Company, a subsidiary of the Eastern Shore Gas & Electric Company, Laurel, Del., is negotiating for the purchase of the municipal electric plant. If acquired the company contemplates extensions and improvements, to cost about $40,000.

PURCELLVILLE, VA. — The Loudoun Light & Power Company plans to erect a new 13,000-volt transmission line in this district, to cost about $40,000.

ROCKYMOUNT, VA.—The property of the Rockymount Light & Power Company has been acquired by the American Electric Power Company. The new owners contemplate increasing the output of the local and plan ultimately to erect a transmission line from Rockymount to Roanoke, a distance of about 20 miles.

YORKTOWN, VA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 16, for 20,000 ft. rubber-covered wire for the local navy yard (Schedule 3896).

WASHINGTON, D. C.—Bids will be received by the Chief of Air Service, United States Army, Washington, until June 16, for 3,000 ft. power and lighting cable (Circular 128).

WASHINGTON, D. C. — Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, until June 22, for one 625-kva. turbo-alternator with exciter, surface condenser, one turbine-driven and one motor-driven centrifugal pump, turbine-driven centrifugal condensate pump, air ejector, switchboard and complete electrical apparatus (Specification 5063).

North Central States

RICHLAND, MICH.—The Consumers Power Company, Jackson, is planning to erect a transmission line in Richland Township, where it has been granted a franchise.

STURGIS, MICH.—The Michigan Gas & Electric Company plans to erect a transmission line from its Mottville generating plant to Sturgis via White Pigeon. It also plans to increase the voltage of the present line between White Pigeon and Constantine.

CLEVELAND, OHIO.—Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until June 19 for the following: For power limiting reactors, subway type constant current regulators, and "White Way" lanterns for the Division of Light and Power.

FAIRFIELD, OHIO. — Bids will be received by the Department of the Interior, Washington, D. C., until June 17, for two motor-driven air compressors for the local intermediate depot.

LORAIN, OHIO. — Arrangements have been made by the City Council with the Ohio Public Service Company for an extension in the ornamental lighting system on Broadway, covering six blocks, to cost about $10,000.

TOLEDO, OHIO.—The City Council has authorized a bond issue of $35,000 to finance the extension of the fire-alarm system to the new districts which have been annexed to the city.

GREAT LAKES, ILL. — Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 24, for installing chain-grate stokers and auxiliary equipment at the local naval station, including removal of present stokers, altering furnaces, ash pits, etc. (Specification 5031).

MOLINE, ILL.—Plans have been approved for the proposed ornamental lighting system in the business district, to cost about $40,000. The plans provide for the erection of 189 standards mounted with single lamps of 1,000 cp.

NOKOMIS, ILL.—The City Council has made arrangements with the Central Illinois Public Service Company, Springfield, for installing ornamental street lamps on several blocks in the down-town section, free of cost to the city.

JANESVILLE, WIS.—Bids are being received by Mead & Seastone, engineers, Journal Building, Madison, for one vertical generating unit, consisting of a 240-hp. turbine directly connected to a 200-kva. generator, governor, etc., for the local plant of the Wisconsin Power & Light Company, Madison.

MATTOON, WIS. — The Public Service Company, Wittenberg, which operates the local system, contemplates the installation of an additional 50 hp. in motors and extension of its lines into rural districts and to Polar. P. H. Fischer, Wittenberg, is secretary and treasurer.

MITCHELL, IOWA. — The Northeastern Iowa Power Company, Clermont, is considering the construction of a new power station at Mitchell, to cost about $225,000.

TRIPOLI, IOWA.—The electric plant of the Tripoli Canning Company has been acquired by the Northeastern Power Company, Clermont. Extensions are contemplated by the new owners.

ST. LOUIS, MO.—Two proposed ordinances have been submitted to the Board of Public Service providing for the expenditure of $1,850,000 of bond issue money for new street lighting for tentative approval. One of the ordinances calls for an expenditure of $400,000 for a new lighting system in the downtown section and for $1,250,000 for new lamps in three residential districts. In the downtown section it is proposed to use an ornamental steel combination trolley and lamp post of the boulevard bracket type. Each post will carry two lamps of 1,500 cp. each. In the three outlying districts the posts will be of concrete, mounted with lamps of 400, 250 and 100 cp. each. A new type of reflector will be used.

DRAKE, N. D.—J. W. Campbell, Jr., Anamoosa, has been granted permission to erect a transmission line to Drake, N. D.

ONEIDA, S. D.—Plans have been approved by the City Council for an addition to the municipal electric plant.

BLOOMFIELD, NEB. — Bonds to the amount of $50,000 have been voted for the construction of a municipal electric light and power plant.

FAIRBURY, NEB.—A special election has been called to approve a bond issue of $11,000 for extensions and improvements in the municipal electric plant.

NORFOLK, NEB.—The City Council has engaged Arthur L. Mullergren, consulting engineer, Gates Building, Kansas City, Mo., to make a report and estimates of cost for a municipal electric light plant, for which a petition has been filed with the City Council to call a special election to vote on the proposal to issue $250,000 in bonds for the project.

Southern States

McCORMICK, S. C.—At an election to be held June 16 the proposal to issue $28,000 in electric bonds, $53,000 in waterworks bonds and $43,000 in sewer bonds will be submitted to the voters.

PARRIS ISLAND, S. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 22 for a 625-kva. turbo-alternator with exciter, surface condenser, one turbine-driven and one motor-driven centrifugal circulating pump, turbine-driven centrifugal condensate pump, an ejector and switchboard complete with all electrical apparatus at the Marine Barracks, Parris Island.

QUITMAN, GA.—An ordinance has been introduced by the City Commission providing for the installation of ornamental lamps on every paved street in the city.

PALM CITY, FLA.—A special election will be held on June 27 to vote on a bond issue for the installation of a municipal electric lighting plant. Riddle & Company, West Palm Beach, are engineers.

VERO BEACH, FLA.—Bids will be received by H. G. Redstone, city clerk, until June 18 for one 750-hp. Diesel engine generator and switchboard; also, for one 5-ton overhead electric crane. Carter & Damerow are engineers.

WEBSTER, FLA.—An election will be held June 30 to vote on the proposal to issue bonds for improvements to the electric light system and for waterworks system.

BENTON, TENN.—The Tennessee Electric Power Company, Chattanooga, contemplates the construction of a new power plant on the Ocoee River, to cost about $200,000. The company has acquired an existing transmission line from Lebanon to Murfreesboro, which it plans to rebuild.

RIVES, TENN.—The Kentucky-Tennessee Light & Power Company, Bowling Green, has been granted a franchise to furnish electricity in Rives.

BIRMINGHAM, ALA.—The Gulf Electric Company has applied to the Public Service Commission for permission to erect an electric transmission line across Lowndes, Butler, Conecuh, Escambia and Baldwin Counties.

DEMOPOLIS, ALA. — The Gulf States Portland Cement Company has contracted with the Alabama Power Company, Birmingham, for power supply for its local mill, which will erect a transmission line to Demopolis.

FORDYCE, ARK.—The Arkansas Light & Power Company, Pine Bluff, has been granted a franchise in Fordyce and plans to erect a transmission line in this section.

JONESBORO, ARK. — Plans are being prepared for a new power station for the municipal electric and water plant. New equipment will be required, including a 1,500-kw. turbine, generator, condenser, etc. Contracts for chimney, boilers, etc., have been awarded. E. J. Wolpert, Jonesboro, is architect; J. F. Christy is manager of the municipal plant.

DONALDSONVILLE, LA.—The proposal to issue $70,000 in electric light and water bonds has been approved by the voters.

HASTINGS, OKLA.—Bonds to the amount of $10,000 have been approved for the erection of a transmission line to Temple for local light and power service.

CUERO, TEX.—The Texas Central Power Company, which owns the Cuero Light & Power Company, plans to build a new dam across the Guadalupe River near here.

HOUSTON, TEX.—Plans are under way by the Houston Lighting & Power Company to extend its transmission system to cover all towns within a radius of 100 miles of its new plant at Deepwater. The distribution system of the Goose Creek Light & Power Company, recently acquired by the Houston company, will be connected with the Deepwater plant by a high-tension transmission line.

LAREDO, TEX. — The Texas Central Power Company, San Antonio, has acquired the Laredo waterworks system and the plant of the Consumers' Ice & Fuel Company and plans improvements, to cost from $50,000 to $60,000, including new waterworks, power house, pumping equipment, etc.

THREE RIVERS, TEX.—The Three Rivers Glass Company, San Antonio, is considering the installation of a power plant of about 150 hp. The equipment will include gas engines and generators. The company plans to supply electricity for lighting the town.

Pacific and Mountain States

BELLINGHAM, WASH. — The Puget Sound Power & Light Company, Seattle, plans to erect a transmission line on the Delta Road.

CHELAN FALLS, WASH. — The Great Northern Railway Company, it is reported, is negotiating with the Washington Water Power Company, Sopkane, for the sale of its Chelan Falls power site, just east of the Cascades. The latter company, it is understood, plans to develop the power site and will furnish electricity to the Great Northern Railway Company in connection with the electrification of its line through the Cascade Mountains. It is estimated that 65,000 hp. can be developed at a cost of about $10,000,000.

PORTLAND, ORE. — Recommendation has been made to the City Council by City Engineer Laurgarrd to accept the bids of the Portland Electric Power Company for the installation of the Broadway ornamental lighting system, with the use of pressed-steel posts. Petitions are now being circulated asking for the formation of a lighting district for Washington Street and others are being planned for Fifth and Sixth Streets in the downtown district, for Foster Road, Grand Avenue and Jersey Street in St. Johns.

BAKERSFIELD, CAL.—Petitions have been approved by the City Council for the installation of new electroliers in more than forty blocks.

FRUITVALE, CAL. — The Southern Pacific Company, San Francisco, plans to install a turbo-generator and accessory equipment in its local plant.

LOS ANGELES, CAL.—The City Council has adopted an ordinance for the installation of ornamental lamps on First Street from Glendale Boulevard to Vermont Avenue, using pressed-steel standards, and on Larchmont Boulevard, from Rosewood Avenue to Third Street, using concrete standards.

LOS ANGELES, CAL.—The Los Angeles Gas & Electric Company plans to expend about $8,000,000 on additions to its generating, transmission and distribution system during the rest of the year. One-half of this amount is to be expended on the new Seal Beach station, together with necessary substations and transmission lines to handle the additional power generated; the balance to be used for general extensions of distribution system, including the purchase of 24,800 meters.

OAKLAND, CAL. — Arrangements have been made between the City Council and local business men for the installation of an ornamental lighting system, to cost about $175,000.

REDDING, CAL. — The Board of City Trustees has approved plans for the installation of ornamental lamps on portions of Market and California Streets.

SAN MARINO, CAL.—The City Council has authorized the installation of an ornamental lighting system on Monterey Road from East Molino to Garfield Avenues.

STOCKTON, CAL.—An ordinance granting the Great Western Power Company a franchise in San Joaquin County has been passed by the City Council.

WATSONVILLE, CAL.—Plans are being prepared by Davis-Heller-Pearce, Inc., Delta Building, Stockton, for a local cold-storage and ice plant for the Union Ice Company, 354 Pine Street, San Francisco, to cost about $350,000.

MESA, ARIZ.—Bonds to the amount of $228,000 have been voted, of which $98,500 will be used for the electric light and gas plants.

MIAMI, ARIZ.—The Miami City Power & Water Company has secured permission to purchase the properties of the I. A. Van Dyke Public Utilities. Extensions and improvements are planned.

GREAT FALLS, MONT.—The Anaconda Copper Mining Company, 25 Broadway, New York, plans to install electric power equipment in connection with proposed additions to its local zinc plant, to cost about $1,000,000. Electric equipment will also be installed in connection with proposed extensions at its local copper works, to cost $500,000.

RENO, NEV.—Plans prepared for the installation of an improved lighting system on portions of West, Sierra, Virginia and Fourth Streets.

Canada

VANCOUVER, B. C.—The City Council is considering the development of a municipal hydro-electric system and is reported to be making an investigation of the Cheakamus River for that purpose.

VANCOUVER, B. C.—The installation of an ornamental lighting system in the business district, to cost about $190,000, is under consideration by the City Council. The work will be done under the supervision of C. H. Fletcher, city electrician.

VANCOUVER, B. C.—The British Columbia Electric Railway Company, which is now building a large hydro-electric plant on Alouette Lake and at the outlet of Stave Lake, it is stated, plans later to develop 80,000 hp. lower down on the Stave River, near Ruskin, where it has obtained an option on a site from the Bridge River Power Company.

SAULT STE. MARIE, ONT.—Surveys of the power situation are being made by the Algoma Steel Corporation preparatory to operating its Steep Hill Falls plant, which supplies power to the Goudreau Gold Mines, Ltd.

Electrical Patents

Announced by U. S. Patent Office

(Issued May 12, 1925)

16,070 (reissue). AUTOMATIC TELEPHONE-EXCHANGE SYSTEM; O. Kirby, Chicago, Ill. App. filed July 30, 1920.

1,537,055. SYSTEM OF DISTRIBUTION; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Oct. 28, 1921. For supplying high-frequency alternating currents derived from two dissimilar sources.

1,537,066. BATTERY-TERMINAL CONNECTION; C. E. Callendar and J. V. Gittinger, Tiffin, Ohio. App. filed Jan. 11, 1924.

1,537,081. MULTIPLE PLUG; F. H. Graham, New York, N. Y. App. filed Dec. 14, 1923.

1,537,088. DEVICE FOR DETECTING SYNCHRONISM; C. F. Jenkins, Washington, D. C. App. filed Feb. 19, 1923.

1,537,098. LIGHTING-FIXTURE SUPPORT; J. Velcio, Youngstown, Ohio. App. filed Feb. 21, 1921.

1,537,099. CARRIER-CURRENT SYSTEM; H. J. Vennes, New York, N. Y. App. filed Dec. 21, 1920.

1,537,101. MEANS FOR CONNECTING DEVICES OF DIFFERENT IMPEDANCE; D. F. Whiting, New York, N. Y. App. filed June 3, 1921.

1,537,103. FEEDING MECHANISM FOR ARC LAMPS; M. J. Wohl, New York, N. Y. App. filed June 15, 1921.

1,537,106. MEANS FOR AND METHOD OF EQUALIZING ATTENUATION; H. A. Affel, Brooklyn, N. Y. App. filed June 2, 1921.

1,537,109. TELEPHONE SYSTEM; J. Davidson, Jr., Trenton, N. J. App. filed Aug. 10, 1920.

1,537,132. SPEED CONTROL FOR MOTOR-DRIVEN SYSTEMS; F. B. Olson, Berlin, N. H. App. filed Jan. 2, 1920. For alternating-current motors.

1,537,133. TROLLEY GUARD; W. K. Page, Olean, N. Y. App. filed Dec. 9, 1924.

1,537,136. ELECTRIC TIME SWITCH; T. J. H. Peirce, Cranston, R. I. App. filed Dec. 29, 1921.

1,537,137. MEASURED-SERVICE TELEPHONE SYSTEM; R. L. Quass, Hawthorne, N. J. App. filed June 6, 1922.

1,537,154. MULTIPLEX SIGNALING SYSTEM; W. V. Wolfe, Corona, N. Y. App. filed Nov. 29, 1922.

1,537,160. CONNECTOR; F. Diehl, Elizabeth, N. J. App. filed Jan. 24, 1924. Applied to and between the ends of a length of flexible twin-conductor cord.

1,537,183. AGRICULTURAL MACHINE; J. S. O'Hara, Romney, W. Va. App. filed Jan. 3, 1925. Operates automatically to travel over all portions of field.

1,537,205. FAC-SIMILE TELEGRAPH; L. Tschorner, Vienna, Austria, and N. Sandor, Dresden, Germany. App. filed Oct. 30, 1920.

1,537,211. SIGNALING SYSTEM; J. H. Wootton, New York, N. Y. App. filed Sept. 7, 1922.

1,537,228. MEANS FOR COOLING CARRIER-WAVE APPARATUS; J. O. Gargan, Brooklyn, N. Y. App. filed June 3, 1922.

1,537,255. CARRIER-CURRENT SYSTEM; J. Mills, Wyoming, N. J. App. filed Dec. 28, 1920.

1,537,272. SAFETY SWITCH; O. T. Sweet, St. Louis, Mo. App. filed Feb. 17, 1919. Knife-blade type.

1,537,283. REPEATER FOR MULTIPLEX SYSTEMS; H. A. Affel, Brooklyn, N. Y. App. filed Sept. 30, 1919.

1,537,296. SAFETY FUSE; A. F. Gearhart, MacDunn, W. Va. App. filed May 5, 1922.

1,537,306. AUTOMATIC TELEPHONE SYSTEM; E. Jacobsen, Port Washington, N. Y. App. filed April 26, 1920.

1,537,317. TELEPHONE SWITCHBOARD; J. H. Levis, Jr., Rochester, N. Y. App. filed March 4, 1922.

1,537,326. MAKE-BUSY SCHEME FOR TELEPHONE SYSTEMS; B. D. Willis, Oak Park, Ill. App. filed Aug. 28, 1922.

1,537,340. PROCESS FOR ASSEMBLING BATTERY CELLS; R. M. Eaton, Niagara Falls, N. Y. App. filed April 15, 1924.

1,537,352. ELECTRICAL APPARATUS; J. D. Hilliard, Schenectady, N. Y. App. filed Oct. 23, 1919. Oil-break type.

1,537,353. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed Feb. 8, 1921. Oil switch.

1,537,371. PROTECTION OF ALTERNATING-ELECTRIC-CURRENT SYSTEMS; W. Petersen, Darmstadt, Germany. App. filed May 8, 1918.

1,537,374. ELECTRICAL INSTRUMENT; W. H. Pratt, Lynn, Mass. App. filed July 27, 1921. To record the kilowatt-hours consumed in a circuit having variable frequency.

1,537,375. CONTROL SYSTEM FOR ADJUSTABLE-SPEED MOTORS; A. C. Prescott, East Orange, N. J. App. filed Dec. 16, 1924.

1,537,378. ARRANGEMENT FOR SUPPRESSING SPARKS; L. Schon, Essen, Germany. App. filed Sept. 4, 1920. In a circuit containing a self-inductive element.

1,537,395. ELECTRIC CLOCK; H. E. Warren, Ashland, Mass. App. filed Nov. 14, 1922.

1,537,407. ELECTRICAL INSTRUMENT; F. P. Church, Lynn, Mass. App. filed July 27, 1921. Induction type for an alternating-current circuit.

1,537,466. INTERRUPTER FOR MAGNETO MACHINES; G. Hunter, Westminster, London, England. App. filed Feb. 16, 1924.

1,537,470. STICK FOR HANDLING HIGH-VOLTAGE LINE CONDUCTORS; T. F. Johnson, Jr., Atlanta, Ga. App. filed Feb. 6, 1923.

1,537,472. ELECTRIC SWITCH; C. Y. Knight, Chicago, Ill. App. filed Dec. 6, 1923. Single-pole type.

1,537,485. JUNCTION BOX FOR ELECTRICAL CONNECTIONS; A. H. Midgley, Uxbridge, England. App. filed April 3, 1922.

1,537,490. TESTING DEVICE FOR ARMATURES AND THE LIKE; T. J. Oman, Elmhurst, N. Y. App. filed Aug. 13, 1921.

1,537,500. ELECTRICAL RESISTANCE; C. E. Scott, Isaban, W. Va. App. filed April 23, 1924. Electric welding.

1,537,504. ELECTRIC LAMP; J. Sheedy, Seattle, Wash. App. filed May 27, 1924. Shade vertically adjustable.

1,537,528. APPARATUS FOR PRODUCING THERMIONIC EFFECTS; C. D. Ehret, Philadelphia, Pa. App. filed April 29, 1919.

1,537,535. SIGNALING BY HIGH-FREQUENCY WAVES; F. W. Kranz, New York, N. Y. App. filed Sept. 29, 1919.

1,537,575. METHOD OF AND APPARATUS FOR APPLYING A SERVING TO A CORE; A. F. Bandur, Berwyn, Ill. App. filed Feb. 24, 1923. For applying loading material to a signaling conductor.

1,537,577. ELECTRICAL IGNITION DEVICE; J. Berg, Chicago, Ill. App. filed April 21, 1923. Cigar-lighter.

1,537,578. MOTOR-CONTROL SYSTEM; E. M. Bouton, Wilkinsburg, Pa. App. filed Sept. 24, 1920. For effecting the intermittent operation of motors for fixed intervals of time.

1,537,607. METER CASING; C. M. Hoeftman, Newark, N. J. App. filed June 16, 1922. Watt-hour-meter cases constructed of sheet metal.

1,537,609. ARC TRANSMISSION SYSTEM; J. V. L. Hogan, New York, N. Y. App. filed May 19, 1922.

1,537,620. SYSTEM OF ELECTRIC CONTROL; F. Schneider, Fulda, Germany. App. filed June 5, 1924. Apparatus for regulating clocks.

1,537,627. SPEED-REGULATOR SYSTEM; S. A. Staege, Pittsburgh, Pa. App. filed April 9, 1919.

1,537,633. MAGNETIC CHUCK; O. S. Walker and I. F. Williams, Worcester, Mass. App. filed March 31, 1919.

1,537,636. ELECTRICAL SYSTEM; C. C. Whittaker, Pittsburgh, Pa. App. filed Dec. 17, 1919. Thermostatic control of ventilating motors.

1,537,639. SWIVEL COUPLING; J. M. Johnson, Kansas City, Mo. App. filed Dec. 28, 1923.

1,537,643. REGULATOR SYSTEM; E. E. Lehr, Wilkinsburg, Pa. App. filed Sept. 16, 1921.

1,537,653. SIGNALING SYSTEM; P. B. Murphy, Nyack, N. Y. App. filed Nov. 10,1921. For signaling over transmission lines.

1,537,668. ELECTRIC DETONATOR FOR USE UNDER HIGH PRESSURES; H. L. Grant, Tamaqua, Pa. App. filed Dec. 24, 1924.

1,537,671. ENERGY-CONVERTING ELECTRICAL INSTRUMENT; C. W. Hewlett, Iowa City, Ia. App. filed Sept. 9, 1920. For converting the energy of variable electric currents into the energy of sound waves and conversely.

1,537,680. INCANDESCENT-ARC DEVICE; G. Klahre, Berlin, Germany. App. filed July 28, 1924.

1,537,682. TELEGRAPHIC RECEIVING SYSTEM; G. Krause, Berlin, Germany. App. filed Oct. 26, 1920.

1,537,689. ELECTRIC CONNECTING PLUG; J. G. Peterson, Hartford, Conn. App. filed May 9, 1924.

1,537,692. DISK COMMUTATOR; P. W. Prouty, Springfield, Mass. App. filed Aug. 14, 1924.

1,537,708. THERMIONIC VACUUM TUBE; W. Schottky, Berlin-Charlottenburg, Germany. App. filed Aug. 27, 1919.

1,537,719. AUTOMATIC SWITCHING EQUIPMENT; B. S. Weinfield, Schenectady, N. Y. App. filed May 12, 1922. Controlling connections between source of polyphase current and plurality of single-phase load circuits.

1,537,721. AUTOMATIC TELEPHONE SYSTEM; J. Wicks, Chicago, Ill. App. filed Aug. 28, 1922.

1,537,727. AUTOMATIC RECLOSING CIRCUIT-BREAKER SYSTEM; A. E. Anderson, Scotia, N. Y. App. filed May 24, 1924.

1,537,728. WIRE TERMINAL; F. H. Bagley, Louisville, Ky. App. filed Aug. 26, 1922.

1,537,737. ALTERNATING-CURRENT COMMUTATOR MOTOR; S. R. Bergman, Nahant, Mass. App. filed July 3, 1922. Squirrel-cage winding.

1,537,740. HEATING ELEMENT; R. H. Bliss, Cleveland, Ohio. App. filed March 12, 1923.

1,537,742, 1,537,743, 1,537,744. TELEGRAPHY; W. M. Bruce, Jr., Springfield, Ohio. App. filed Oct. 4, 1919. Submarine cables of high capacity.

1,537,745. PRINTING TELEGRAPHY; W. N. Bruce, Jr., Springfield, Ohio. App. filed Feb. 12, 1921.

1,537,750. HIGH-TENSION LIQUID-BREAK SWITCH; N. J. Conrad, Wilmette, Ill. App. filed June 16, 1924.

1,537,756. INCASED TRANSFORMER; E. D. Eby, Pittsfield, Mass. App. filed May 8, 1923. High-tension transformer of small current capacity as an instrument transformer.

1,537,770. POSITIONING MECHANISM FOR SEARCHLIGHTS; E. Hall, Brooklyn, N. Y. App. filed Aug. 23, 1919.

1,537,774. LIMIT SWITCH FOR ELECTRIC HOISTS; S. E. Kalbach, Reading, Pa. App. filed Nov. 11, 1924.

1,537,781. RECIPROCAL TELEPHONE REPEATER; W. Ohnesorge, Dortmund, Germany. App. filed Aug. 30, 1921.

1,537,796. ELECTRIC FLASHER; G. L. Bossard, Troy, N. Y. App. filed June 1, 1920.

1,537,831. LIGHTING FIXTURE; E. A. Koenig, San Francisco, Cal. App. filed May 20, 1924. Concealed socket.

1,537,836. SWITCH-POINT ASSEMBLY; S. M. Lauter, Brooklyn, N. Y. App. filed Feb. 19, 1923.

Financial and Corporate

Utility Shares Recede

Weakness in General Market Has a Bad Effect on Power and Light Market Values

THE rise to new high peaks for all time in a long list of industrial and power and light stocks has been followed, as is usually the case after sharp advances, by a period of adjustment in which values have been lowered. No very large volume is represented in the substantial decline that was registered last week by the utility stocks, but the previous advances had been achieved likewise without a very large turnover. Unquestionably the recent comment with regard to the possibility of a contraction of loans on curb utility stocks has had its bad effect on the prices of many power and light issues, but the principal cause lies in the general condition of the markets. Stocks had moved forward pretty fast and time is needed for digestion.

Notwithstanding the poorer condition of the market, General Gas & Electric added another forty points to its position of the week before, although the turnover of a relatively few shares in this stock now is sufficient to drive it forward in smart fashion. On the New York Stock Exchange attention has been drawn to the shares of the Havana Electric Railway, Light & Power Company, which within a month have moved from 112 to about 184 on reports of accumulation for purchase of control and on earnings improvement.

But such stocks were the exception. In general the movement was in the opposite direction. Commonwealth Power Corporation lost thirteen points during the week, and Lehigh Power Securities, another popular leader in the speculative markets, lost sixteen points. National Power & Light, which is subject to wide price changes on relatively small trading, lost heavily during the week. Smaller losses were sustained by such issues as American Water Works & Electric, Electric Bond & Share, North American, American Power & Light and Southeastern Power & Light.

March Revenue 7.2 per Cent Over That of Last Year

Reports received by the ELECTRICAL WORLD from central-station systems representing 76 per cent of the generator rating of the country indicate that the total gross revenue for the sale of energy during March was $119,500,000, or a daily average of $3,850,000, an increase of 7.2 per cent over March of last year. During March the gross revenue was 4.8 per cent below the estimated normal for that month based upon the operations of the industry during the past five years. A revision has been made of the estimated trend in gross revenue which indicates that the revenue has been below normal since last December. The gross revenue of the industry for the first quarter of the year was $379,300,000, a gain of 8.7 per cent over the first quarter of 1924. If this gain is maintained for the remainder of the year, the total revenue for 1925 will total approximately $1,470,000,000 against $1,355,000,000 for 1924.

The operating expenses during March totaled $53,100,000, a gain of 7.2 per cent over March of last year. The operating expenses for the first quarter of the year were $161,500,000, a gain of 5.8 per cent over the first quarter of 1924. The operating ratio, or ratio of the operating expenses to the gross revenue, for companies operating steam-electric generating plants only was 43.0 per cent during March and 43.7 per cent for the quarter. The average operating ratio for the first quarter of 1924 was 46.2 per cent, indicating an improved condition in the operating finances of the industry over those of last year.

Havana Electric Attracts Attention

Business of This Cuban Utility Company Has Grown Steadily for Years—Earnings Large on Stock Notwithstanding Big Deductions for Reserves

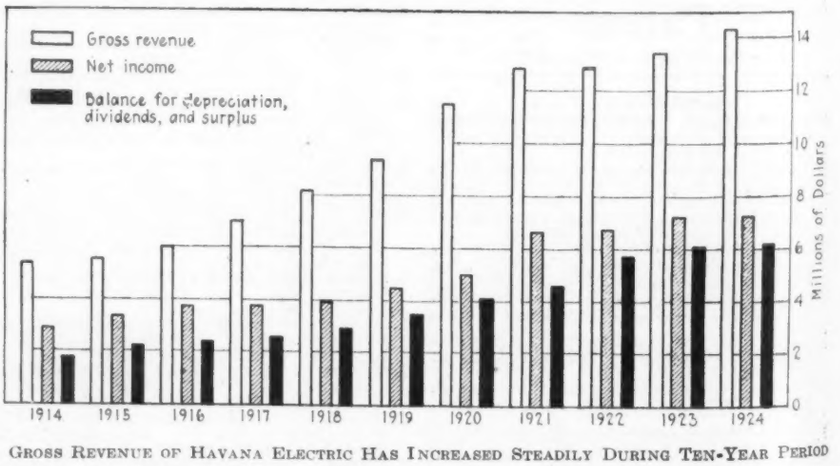
BY PAUL WILLARD GARRETT

SUDDEN interest in Havana Electric Railway, Light & Power Company stock listed on the New York Stock Exchange has within the space of a month driven the market price forward from 112 to about 184. Inquiries increase from people who want to know more about this interesting Cuban utility, which for years has been pretty well known to bondholders but which heretofore has not attracted so much attention from stockholders.

Organized in 1912 as a New Jersey corporation, Havana Electric, as it is commonly called, years ago acquired all of the rights, franchises and properties of several predecessor companies. It does the entire electric light, power, gas and street-railway business of Havana and, incidentally, operates the suburban street railway to Marianao. All of the franchises run for long periods and the electric and gas franchises are perpetual.

Some analysts have expressed doubts over Havana Electric's ability to grow, but certainly in the history of the company since its organization thirteen years ago little basis can be found for such fears. In a manner as remarkable as that in which some of our own star power and light utilities have developed the business of this Cuban enterprise has mounted year by year. Gross revenues in every year have shown a substantial improvement over the preceding year. From $5,396,714 in 1914 these yearly gains have swelled the total to no less than $14,357,901 for 1924. Net income likewise has undergone a persistent improvement, the total for the same years having risen from $2,903,511 to $7,264,002.

Since interest charges have scarcely increased at all during these thirteen years of steadily improving earnings, larger and larger margins have been shown for fixed charges and larger and larger sums have been made available for depreciation, dividends and surplus.



GROSS REVENUE OF HAVANA ELECTRIC HAS INCREASED STEADILY DURING TEN-YEAR PERIOD

The company pays only 6 per cent to the common stock, but the intrinsic position of the stock, even taking into account certain problems that face the management, has steadily improved. Earnings on the common as reported are substantial, but since unusually large deductions are made for depreciation reserves and contingencies a very much better showing could be

made if only the usual deductions were entered. Thus out of gross operating revenues of $14,357,901 in 1924 and net profits from operation and miscellaneous income of $6,175,052, Havana Electric set aside $3,240,638 as reserve for depreciation and contingencies.

The electric light and power division of Havana Electric is the part of the business that is most important and that is growing most rapidly, but electric railways still represent a large investment. Thus the $6,445,152 received in gross earnings from operation of the electric light and power properties out of total gross earnings of $14,357,901 contributed no less than $4,290,574 of the total operating net of $6,924,316. Gross earnings from the railways were $5,924,606 against $6,445,152 for the electric light and power properties, but the net income from operation of the railways equaled only 30.44 per cent of the total gross revenues, whereas net from the electric light and power division equaled 66.57 per cent.

Havana Electric Railway, Light & Power Company has a funded debt of $20,781,740. Stock is outstanding to the amount of $35,919,808, of which $20,976,587 is 6 per cent cumulative preferred and $14,943,221 is common stock. Properties are carried on the balance sheet at $66,283,398.

Company Reports

The following statements of earnings were recently issued by electric light and power companies for the month of April:

Name of Company	Gross Earnings for April 1925	1924
American Water Wks. & Elec.	$3,304,759	$3,233,626
Bangor Hydro Electric	127,327	130,111
Baton Rouge Electric	61,319	55,626
Binghamton Lt., Ht. & Pwr.	127,200	110,972
Blackstone Valley Gas & Elec.	407,895	380,371
Central Illinois Light	297,594	303,854
Central Mississippi Valley elec. properties	48,911	49,457
Columbus Electric & Power	225,221	197,977
Commonwealth Power	2,602,124	2,626,381
Consumers Power	1,674,042	1,533,805
Eastern Texas Electric	196,866	179,670
Edison Elec. Illg. of Brockton	132,673	127,191
Elec. Lt. & Pwr. of Abington & Rockland	37,568	32,390
El Paso Electric	214,787	194,100
Florida Public Service	83,004	66,807
Galveston-Houston Electric	318,543	315,455
Great Western Power	645,949	628,984
Houghton County Elec. Lt.	39,278	42,553
Idaho Power	221,058	215,174
Kansas City Pwr. & Lt.	826,653	792,988
Keokuk Electric	34,673	34,907
Key West Electric	20,845	19,787
Lowell Elec. Light	135,682	122,315
Metropolitan Edison	692,029	651,403
Mississippi River Power	280,108	273,364
New Jersey Pwr. & Lt.	96,953	87,532
North Carolina Public Service	152,297	123,822
Northern Ohio Power	950,147	852,188
Northern Texas Electric	190,141	224,264
Paducah Electric	54,114	49,920
Pennsylvania Edison	238,489	253,169
Philadelphia Co. and affiliated companies	5,199,081	5,340,481
Portland Electric Power	908,016	920,209
Puget Sound Pwr. & Lt.	1,038,004	1,030,659
Savannah Elec. & Pwr.	156,821	152,482
Sierra Pacific Electric	91,801	89,987
Southern California Edison	1,971,348	1,618,633
Southern Indiana Gas & Elec.	211,055	208,657
Tampa Electric	248,320	182,291
Tennessee Electric Power	970,285	772,662
United Gas & Electric	1,194,333	1,128,966
Utah Power & Light	748,158	710,792
West Penn Company	2,130,516	2,204,995

Fitkin Interests Expand.—As foreshadowed in the ELECTRICAL WORLD for April 11, page 787, the Municipal Service Company, operating nine subsidiaries in Virginia, Pennsylvania, Georgia and Ohio, has been acquired by the National Public Service Corporation, the holding company for the various Fitkin properties. With this latest addition the National will have a property value of more than $100,000,000. The territory served by the new subsidiary has a population of about 500,000.

New Capital Issue.—The Twin State Gas & Electric Company during the past week offered a new issue of first lien and refunding mortgage 5½ per cent gold bonds, series A, totaling $1,900,000. These bonds were priced at 95¾ and interest, yielding over 5¾ per cent.

Record Customer Stock Sales in March

Based upon monthly reports received by the ELECTRICAL WORLD from electric light and power companies selling stock direct to customers and employees, it is estimated that during March a total of 468,000 shares were sold in this manner. The total value of this stock is estimated at $45,100,000, which is by far the highest figure ever recorded for this type of central-station financing. A total of 53,000 customers or employees bought this stock.

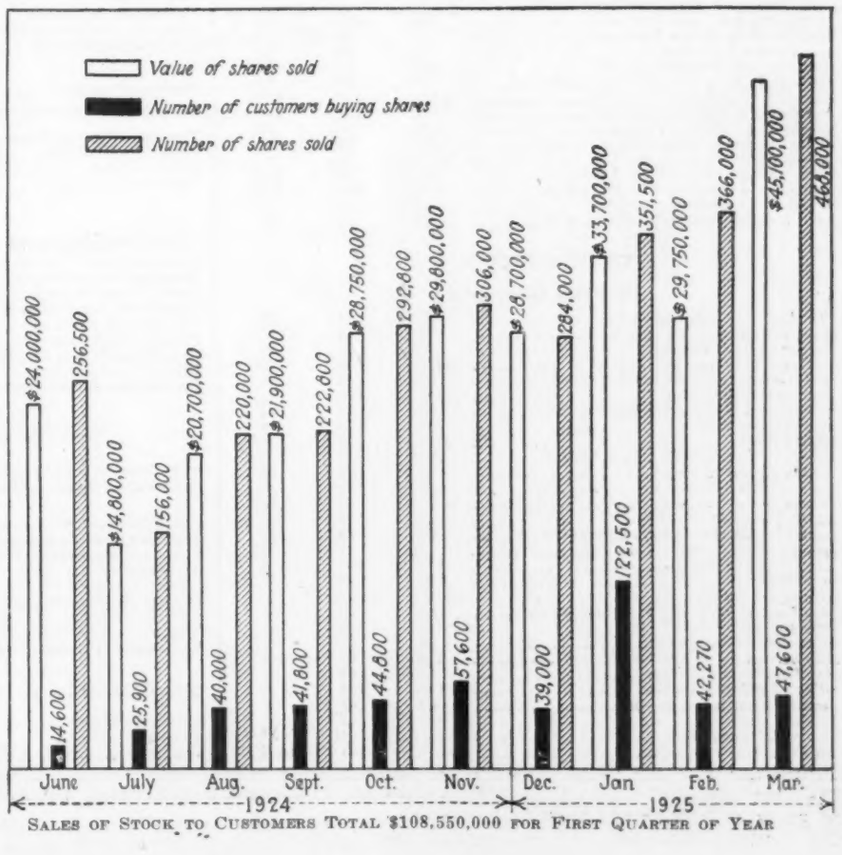
During the first quarter of the year a total of 1,185,500 shares were sold under the customer-ownership plan. The value of this stock is estimated at $108,550,000, and it was sold to 217,770 customers. There is a certain amount of duplication in the number of purchasers during the quarter which is impossible to eliminate with the data at hand. The average sale to each customer was $500.

Dividends Declared

The quarterly dividends listed below were announced recently by electric light and power companies:

Name of Company	Per Cent	When Payable
American Gas & El. com. extra.*	....	July 1
American Gas & Electric, com.	25c.	July 1
American Gas & Electric, pf.	1¾	Aug. 1
American Public Service, pf.	$1.75	July 1
American Public Utilities, pr. pf.	$1.75	July 1
American Public Utilities, pte. pf.	$1.50	July 1
Bangor Hydro-Electric, pf.	1¾	July 1
Calumet Gas & Electric, pf.	1¾	June 17
Central States Electric, pf.	1¾	July 1
Electric Power & Light, pf.	$1.75	July 1
Illinois Power & Light, 7% cum.pf.	1¾	July 1
Illinois Power & Light, 6% pte.pf.	1¾	July 1
Minnesota Power & Light, pf.	1¾	July 1
Missouri Power & Lt., 7% cum. pf.	1¾	July 1
Mountain States Power, pf.	$1.75	July 20
Newport News & Hampton Ry., Gas & Elec., pf.	1¾	July 1
Niagara, Lockport & Ont. Pwr., com.	0.50	July 1
Niagara, Lockport & Ont. Pwr., pf.	1¾	July 1
North American Lt. & Pwr. 7% cum. pf.	1¾	July 1
North West Utilities, pr. lien pf.	$1.75	July 1
Northern New York Utilities	.75	July 1
Northern States Power, pf.	$1.75	.....
Northern States Power, class A com.	2	.....
Power Corp. of New York, com.	.25	July 1
Power Corp. of New York, pf.	$1.75	Aug. 1
Public Service Electric & Gas, 7% pf.	1¾	June 30
Standard Gas & Electric, com.	.75	July 25
Standard Gas & Electric, pr.pf.	$1.75	July 25
Tennessee Electric Power, 7% 1st pf.	1¾	July 1
Tennessee Electric Power, 6% 1st pf.	1¾	July 1
United Light & Power, class A pf.	$1.62	July 1
United Light & Pwr., class B pf.	$1.00	July 1
United Light & Pwr. class A and class B, com.	0.50	Aug. 1
United Light & Railways, 1st pf.	1¾	July 1
United Light & Railways, pte. pf.	2	July 1
United Light & Railways, com.	2	Aug. 1
Utah Power & Light, pf.	1¾	July 1
Virginia Railway & Power, pf.	1¾	July 20
Western States Gas & Elec., pf.	$1.75	July 15
Allis-Chalmers Mfg., pf.	1¾	July 15
Canadian General Electric, pf.	1¾	July 1
Century Electric, com.	1¾	June 22
Century Electric, pf.	1¾	July 1
Emerson Electric Mfg., pf.	1¾	July 1
Manhattan Electrical Supply, com.	$1	July 1
Matthews Corporation, W. N., pf.	7	July 1
Nizer Corporation, cvt. pre. class A	0.75	July 1
Westinghouse Elec. & Mfg., com.	$1	July 31
Westinghouse Elec. & Mfg., pf.	$1	July 15
Weston Elec. Instrument, Class A.	0.50	July 1

*One-fiftieth share common.



SALES OF STOCK TO CUSTOMERS TOTAL $108,550,000 FOR FIRST QUARTER OF YEAR

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, June 6	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	104	98	106
Appalachian Power, 7 per cent	97½	92	100
Arkansas Light & Power 7 per cent	96	92	98
Asheville Power & Light 7 per cent	a100	100	101
Central Illinois Public Service 6 per cent	92	84	93
Colorado Power 7 per cent	94	93	98
Connecticut Light & Power 7 per cent	106	105	110
Consumers' Power 6 per cent	93	90	93½
Dayton Power & Light 6 per cent	94	88	100
Duquesne Light 7 per cent	111	105	111
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	a101	101	103
Great Western Power 7 per cent	102	...	...
Illinois Northern Utilities 6 per cent	88	82	92
Illinois Power & Light 7 per cent	95	92½	98
Kansas Gas & Electric 7 per cent	a 99	99	101
Long Island Lighting 7 per cent	102	100	105
Minnesota Power & Light 7 per cent	a 99	99	101
Mississippi River Power 6 per cent	90	87½	92
Nebraska Power 7 per cent	a100	100	102
Niagara Falls Power 7 per cent—25	28½	28	29
Niagara, Lockport & Ont. Power 7 per cent	109	101½	110
Northern States Power 7 per cent	96	95	100
Ohio Public Service 7 per cent	97½	97	100
Pacific Gas & Electric 6 per cent	95½	92	97
Pacific Power & Light 7 per cent	a 99	99	101
Penn-Ohio Power & Light 7 per cent	94	91	100
Pennsylvania Power & Light $7—no par	a102½	102	103½
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	37⅞	37½	45
Southern California Edison 8 per cent	120	115	122
Southern California Edison 7 per cent	106	105	107½
Southern California Edison 6 per cent	93	90	93
Tennessee Electric Power, 6 per cent	83	80	84
Texas Power & Light 7 per cent	a101	101	103
Utah Power & Light 7 per cent	a 99½	99½	101
Western States Gas & Electric 7 per cent	89	82	89
Yadkin River Power, 7 per cent	a100	100	101
Holding Companies			
American Gas & Electric 6 per cent—no par	89	85	90
American Light & Traction	98½	93	100
American Power & Light 6 per cent	88½	84	90
American Public Service 7 per cent	91	88	94
American Public Utilities 7 per cent	89	87	95
American Water Works & Electric 7 per cent	101	100	103
Associated Gas & Electric 7 per cent—1 per cent extra—50	a 52	...	...
Associated Gas & Electric—$6—no par	84	...	...
Carolina Power & Light 7 per cent	104	100	105
Central Indiana Power 7 per cent	89	88	95
Cities Service 6 per cent	81	80	83
Commonwealth Power 6 per cent	83	80	85½
Continental Gas & Electric 7 per cent pr. pf.	92	89	95
Electric Bond & Share 6 per cent	a103½	103	105
General Gas & Electric—$8—no par	112	104½	116
*Middle West Utilities 7 per cent	96	91½	98¼
National Power & Light—$7—no par	99	95	99
North American 6 per cent—50	a 49¾	46½	50½
Public Service Corp. of N. J. 7 per cent	102	99	102½
Public Service Corp. of N. J. 8 per cent	114½	108½	114½
†United Gas Improvement—50	58	56½	58½
United Light & Power—$6.50—no par	85	83	89
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	83	31	85
Appalachian Power—no par	77½	70	83
Arkansas Light & Power	95	65	95
Brooklyn Edison	a133	120½	140½
Buffalo General Electric—no par (new)	66	44	69
*Commonwealth Edison	140	130½	141½
§Consolidated Gas, Electric Light & Power	42½	32	44
Dayton Power & Light	420	180	460
Detroit Edison	a123	110	125½
|| Edison Electric Illuminating of Boston	209½	200	213
Long Island Lighting (new)	87	60	87
Mississippi River Power	48	37	48
Montana Power	a 78½	64	87½
Niagara Falls Power—no par	66	45½	69
Niagara, Lockport & Ontario Power—no par	65	60	73
Northern Ohio Power	9½	5	13½
Northern States Power	114	103	118
North Texas Electric	40	40	70
Pacific Gas & Electric	a115½	102½	118½
‡Penn Central Light & Power—no par	65	60	67
§Pennsylvania Water & Power	140	126½	144½
‡Philadelphia Electric—25	38	37½	47½
Public Service Co. of Northern Illinois	114	97	116
Puget Sound Power & Light	53	49	61
Southern California Edison	116	102	116
Tennessee Electric Power—no par	63	47	67
Virginia Power	65	65	92
Virginia Railway & Power	a119½	64½	123
West Penn. Co.	132	105	145

Companies	Bid Price Saturday, June 6	Low 1925	High 1925
Holding Companies			
American Gas & Electric—no par	79	70	85
American Light & Traction	160	139	172
American Power & Light	60	52	67
American Public Utilities	78	70	85
American Water Works & Electric	a 64¾	34½	68
Associated Gas & Electric, Class A	a 33	...	...
Carolina Power & Light	390	290	425
Cities Service (new)	37	34	43
Columbia Gas & Electric—no par	a 63½	45¼	69½
Commonwealth Power Corp.—no par	155	106	168
Consolidated Gas—no par	a 86⅞	74½	89½
Continental Gas & Electric	84	77	90
Electric Bond & Share Securities	a 70	69½	75½
Electric Power & Light	a 32⅞	17⅜	37
Federal Light and Traction	a 30½	30	33½
General Gas & Electric	125	72	130½
Lehigh Power Securities—no par	140	82	140
*Middle West Utilities—no par	94	82½	102½
National Power & Light—no par	330	185	330
North American—10	a 47¾	41½	50½
Philadelphia Co.—50	a 56	51½	59½
Power Securities—no par	17	...	...
Public Service Corp. of N. J.—no par	a 69½	62½	74
Standard Gas & Electric—no par	a 50½	40½	54½
United Gas & Electric (Conn.)—no par	45	26	47
BONDS			
Operating Companies			
Adirondack Power & Light	6s 1950	105½	102½ 105½
Alabama Power	5s 1946	99½	96 100
Appalachian Power	5s 1941	99	96 99½
Brooklyn Edison	5s 1949	102½	99½ 103
Cleveland Electric Illuminating	6s 1930	105	104 105½
Commonwealth Edison	5s 1939	101½	100 102
	5s 1943	101½	99½ 102
	5s 1953	100	98⅝ 101
§Consol. Gas, Elec. Lt. & Pwr.	4½s 1935	97½	93½ 97½
	5½s 1949	107½	104⅝ 107½
Consumers' Power	5s 1936	100½	99 100½
	5s 1952	99½	98½ 100
Detroit Edison	5s 1933	101	99⅝ 102½
Duquesne Light	6s 1949	106½	104⅝ 107½
Great Western Power	5s 1946	98½	95 99
Kansas City Power & Light	5s 1952	100½	95⅝ 101
Mississippi River Power	5s 1951	99	96½ 100
Montana Power	5s 1943	100	97⅝ 100½
New England Power	5s 1951	101½	100¼ 102
New York Edison	6½s 1941	115⅝	112 115½
Niagara Falls Power	6s 1932	105½	103½ 106
Northern States Power	5s 1941	98⅜	93 99½
	6s 1941	104½	103 107½
Ohio Power	7s 1951	106½	106½ 107½
Pacific Gas & Electric	5s 1942	98½	93½ 98½
Pennsylvania Water & Power	5s 1940	101	99½ 102
‡Philadelphia Electric	5s 1966	103½	100½ 103⅜
	5½s 1947	106½	103½ 106½
	6s 1941	108	106 108
Portland Electric Power	6s 1947	100	96½ 100
Southern California Edison	5s 1939	100½	99 101
	6s 1944	104½	102⅝ 104½
Tennessee Electric Power	6s 1947	103½	99½ 104½
Texas Power & Light	5s 1937	98½	97 99½
Toledo Edison	7s 1941	109½	108½ 110
Utah Power & Light	5s 1944	97½	91 98½
Holding Companies			
Alabama Traction, Light & Power	5s 1962	93	86 95
American Gas & Electric	6s 2014	98	96½ 98½
American Power & Light	6s 2016	97	94 98
Amer. Water Works & Electric	5s 1934	97	92½ 98
Associated Gas & Electric	6½s 1954	a101½	... ...
Central Indiana Power	6s 1947	98½	95½ 98½
Commonwealth Power	6s 1947	102½	97½ 102½
Consolidated Cities Lt., Pwr. & Tr.	5s 1962	81½	75½ 82½
Illinois Power & Light	6s 1953	102½	102½ 102½
United Light & Railways	5s 1932	97	93½ 97
	6s 1952	100½	95½ 100½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	108	103½	108
Worthington Pump & Machinery A	a 82	79	88
COMMON STOCKS			
Allis-Chalmers Manufacturing	a 80¾	71½	86½
American Bosch Magneto—no par	a 32½	26½	54½
Electric Storage Battery—no par	a 63⅝	63	70⅝
General Electric	a284½	227½	320
General Electric—10	a 11½	11	11½
*Hurley Machine—no par	51	41½	56
†Wagner Electric	38½	26½	50
Westinghouse Electric & Manufacturing—50	a 71½	66½	84
Worthington Pump & Machinery	a 39	56½	79½
BONDS			
General Electric	3½s 1942	83½	83 84
	5s 1952	105½	101½ 106
Robbins & Myers	7s 1952	72	63½ 73½
Western Electric	5s 1944	100½	98 101
Westinghouse Electric & Mfg.	7s 1931	107	106½ 108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange §Baltimore Stock Exchange.
a Bid price, low and high, Tuesday, June 9.